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Liberalization Sequencing and Currency Instability:
A Case Study of 20 Emerging Economies

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Abstract

Financial crises and currency instabilities within developing
and emerging economies during the last decade had a
tremendous impact on the economic performance and
increased vulnerability of economies against domestic and
foreign shocks. The timing of capital liberalization is one of
the significant debates among other issues related to
currency instability, and it would be more convenient to
take this policy whenever the economy is ready for it. In this
study trade openness is assumed to be a perquisite for
capital liberalization. The aim is to see whether the capital
liberalization without enough trade openness would be a
possible factor for the currency instability. To reach to this
aim, a sample of emerging countries for the period of 1998-
2009 is selected. A Probit Panel Data model is used to
estimate the parameters of the model. The parameters are all
found to be significant and support the main idea of this
study.

JEL Classification: F32, C35.

1. Introduction

Although almost all economists believe in the vital role of capital movements among developing and emerging countries, at the same time they also acknowledge that, capital flows can create high risks for the involved countries. Therefore liberalizing capital flows as an important policy toward economic development should be taken very carefully. In this way the sequencing of capital account liberalization is very important, and for each country with different characteristics it is probably different. However, taking this policy not only needs an appropriate schedule to be done successfully, but also needs to be conducted along with other appropriate policies in other sectors of the economy. One of the important policies which is very close to the capital account liberalization is the trade liberalization. The literature in this area shows that if a country is interested in developing its financial system through capital account liberalization, trade liberalization is an important prerequisite to support it. In this study, the difference between the level of trade liberalization and capital account liberalization and the possibility of currency crises is studied. The idea is that if a country has a higher level of capital account liberalization compared to the level of trade openness, then it could be a possible reason for a currency crisis to occur.

To examine the idea of this study, 20 emerging countries for the period 1998-2009 are selected. To determine if a country has a currency crises or not an index including the exchange rate, interest rate and foreign reserves is defined and by using an appropriate criterion the years with currency crises for each country are figured. This has been used as the dependent variable of the equation that is built to examine the hypothesis of this study. Following the literature, the important variables involving currency attacks are used as explanatory variables. A composite index using the capital control index and the trade freedom index as our control variable is included among the explanatory variables and to the best of our knowledge this has not been done in the literature.

The estimation of the parameters of the model is conducted using a Probit Panel Data framework, because the dependent variable of the model is a binary variable. The results of the estimation support the idea of this study and all the parameters are statistically significant.

The remainder of this paper is as follow; in section II, the literature review of the study is briefly explained. In section III, the methodology of the study including the explanation of explanatory variables, dependent variable and structure of the model are provided. Section IV shows the source of the data for the empirical model of this study. The empirical results and the summary and conclusion are contained in sections V and VI respectively.

2. Literature Review

Capital account liberalization policy has been a challenging issue for most of developing and emerging countries in the last few decades following the globalization phenomenon. On the one hand, as it is well explained in the literature, capital is an important economic growth engine and necessary for the suitable performance of economies, but on the other hand mismanagement of capital flows among countries could potentially create difficulties for policy makers.

Historically, the remarkable amount of capital movement among countries started from the early 1990$_s$ and both structural forces within emerging economies and cyclical forces in the most developed countries increased the flow of capital among them (López-Mejía, 1999). These financial flows boosted productivity and economic performance of emerging economies and benefitted the developed countries. Most academics and policy makers believe that capital account liberalization noticeably improves efficiency in an economy because it enables productive resources to be applied where they can be most efficiently utilized. Therefore, while there are enough reasons to ease capital flows among countries, especially those who need more capital, being in the first stage of economic growth, empirical studies in the literature show that it could make the countries more vulnerable prior to or during financial crises. Therefore, even in the International Monetary Fund (IMF) these kinds of policies are advocated with a higher level of caution and they support a reasonable level of capital controls (Edwards, 2004).

The literature shows different processes for the occurrence of currency crises, and, based on them, different models of currency crisis are modeled. The first and famous model which is called a *first generation* model (or the standard model) of currency crises is explained simply in the study of Flood & Garber (1984). The explained mechanism in this model is based on the study of Salant & Henderson (1978) in the

goods market. In the standard model of currency crises it is believed that the central bank tries to peg the exchange rate at a fixed level against that expected by currency speculators. Current account deficit and an increase in domestic credit is a sign of currency attack in this model. The role of domestic credits is well explained in the study of Pesenti & Cedric (2000). The *second generation* models explained by Eichengreen, Rose & Wyplosz (1996) and Sachs, Tornell & Velasco (1996), are mostly focused on the modeling of self-fulfilling behaviour in triggering a crisis. In *third generation* models vulnerability of the financial and banking system is believed to be at the core of a currency attack (see Krugman, 1999). The next theoretical framework to explain occurrence of currency crises is the role of weak institutions which is elaborated in the study of Shimpalee & Breuer (2006). In almost all of these currency crises models the role of policy makers is very vital. Policies like capital account liberalization and trade openness are some of the interesting examples. While there are many studies in the literature explaining the sequencing of liberalization for each policy, there are few studies about optimal policy making to avoid an exchange rate attack in emerging economies. Hiro (2006) discusses whether financial liberalization can improve financial development and if the trade liberalization is a prerequisite for financial liberalization. Using data for 87 developing countries for the time period of 1998-2000 Hiro concludes that trade liberalization is a precondition for financial development following capital account liberalization. The aim of the current study is to see if liberalizing trade prior to liberalizing the capital account could be a possible impact to increase the vulnerability of a country (especially in an emerging economy) to currency attacks and eventually increase the probability of a currency crises. In the next section the methodology of this study in order to answer this question is discussed.

3. Methodology

To attain the aims of this study a functional form for currency instability is specified and some explanatory variables are defined and applied. The dependent variable is currency crises and explanatory variables are capital controls index, domestic credit growth, current account to GDP ratio, real GDP growth and a dummy variable if the trade liberalization index is higher than the capital liberalization index. The econometrics approach selected to estimate the parameters of the model is the Probit

Panel data model[1], because the dependent variable takes the value of one or zero. In the rest of this section, there are more explanations about the model and its components.

Currency crisis

In order to show the existence of currency instability as a dependent variable, different methods have been used in the literature. In some studies like Edwards & Montiel (1989) a narrow index of exchange rate devaluation is used to show the existence of a currency crisis (See Edwards & Santaella, 1993; Frankel & Rose, 1996). In another study, if a capital inflow suddenly changes to capital outflow, it is considered as an instability (See Radelet & Sachs, 1998).

Kaminsky, Lizondo & Reinhart (1998) have used a signals approach to show a currency crises. In their index called KLR, they use *leading indicators* and they believe the behavior of an economy in a crisis is different from a situation without it and it would be possible to track unusual behavior as a currency crisis. Some variables like exports, broad money to reserve ratio, equity prices, output and the exchange rate are used in this method. When the change in an indicator is higher than the specified threshold it is interpreted as a sign of a crisis in the near future (next 24 months) but this signal could be false or true. "The choice of threshold determination involves striking a balance between Type I (Rejecting H0 when H0 is true) and Type II (Accepting H0 when H0 is false) errors. The sizes of the errors are α and β, respectively. If α is 0 (the threshold is too lax), then the indicator will catch all the crises, but will give lots of false signals (noise). If β is 0 (the threshold is too tight), the indicator will never issue a false signal, but it will miss all the crises. Hence, for each variable, the critical region is selected so as to minimize the noise-to-signal ratio:" (Saxena & Wong, 1999, p. 17)

$$\text{Noise-to-signal ratio} = \frac{\beta}{1-\alpha} \tag{1}$$

Where $(1 - \alpha) = \dfrac{Number\ of\ months\ with\ good\ signals}{number\ of\ months\ in\ the\ crisis\ window}$

$$\beta = \frac{number\ of\ months\ with\ bad\ signals}{number\ of\ months\ outside\ the\ crisis\ window}$$

Kaminsky & Reinhart (1999) have used a "*Currency Market Turbulence*" index for capruting a currency crisis. Their index as shown by I, "is a weighted average of the rate of change of the exchange rate, D*e*/*e*, and of reserves, D*R*/*R*, with weights such that the two components of the index have equal sample volatilities" (Kaminsky & Reinhart, 1999, p. 498)

$$I = \frac{\Delta e}{e} - \frac{\sigma_e}{\sigma_R} \cdot \frac{\Delta R}{R} \qquad (2)$$

Where σ_R is the standard deviation of the reserves and σ_e is the standard deviation of the exchange rates. The sign for changes of the exchange rate is positive and for reserves it is negative. Any case with more than 3 times the standard deviation of the index plus the average, is assumed to be a crisis. The index explained above does not include the interest rate, then it is necessery to apply a broader sense of that index in this study. Following Eichengreen, Rose & Wyplosz (1996) and Saxena & Wong (1999) the index used in this study will include the interest rate. Then we can reformulate the above formula to obtain another criteria which is called the *Market Pressure Index* (MPI) and is defined as below:

$$MPI_{i,t} = \frac{(\% \, \Delta e_{i,t})}{(\sigma \Delta e_{i,t})} + \frac{(\Delta I_{i,t})}{(\sigma \Delta I_{I,T})} - \frac{(\% \, \Delta R_{i,t})}{(\sigma \Delta R_{i,t})} \qquad (3)$$

Where $e_{i,t}$ is the exchange rate of country i at time t (bilateral exchange rate with the US), $I_{i,t}$ is the interest rate of country i at time t, and $R_{i,t}$ is international reserves minus gold of country i at time t (owned by the central bank of each country). The variables used in MPI are all divided by their standard deviation to obtain a weighted value. Basically, when there is pressure on each country's currency, MPI is high and otherwise it is low.

Based on the currency crises theories, it is believed that if there is any speculative attack on the currency the exchange rate would depreciate, or the interest rate would be raised to stop the attack, or the central bank would sell international reserves to support the exchange rate.

Monthly data is used to construct the MPI for each year-country. The criteria below is used to see if there is any currency crisis or not for each year-country.

If $MPI_i > \propto_{MPI_i} + 1 * \sigma_{MPI_i} \rightarrow CC = 1$, and $CC = 0$ otherwise   (4)

Where CC shows the existence of a currency crisis and takes the value of 1 in the case of a crisis and 0 otherwise. $\propto_{MPI_i}$ is the mean of the MPI of country i and σ_{MPI_i} is the standard deviation of MPI for country i. The coefficient of the last term (1) is a value which shows the sensitivity of the process of defining a crisis. The higher this value the lower the sensitivity of the index. In some studies the value of 3 is used for that, but in this study it is preferred to use a lower value to increase the degree of sensitivity in terms of capturing the years with currency instability. Therefore, by using this criteria, if there is any month defined as a month with a crisis, then the related year is considered as a year with a currency attack (crises=1, no crisis=0). In this way there is a binary variable which builds the dependent variable of our model. As can be seen below the defined variable for each country is shown in Figure (1).
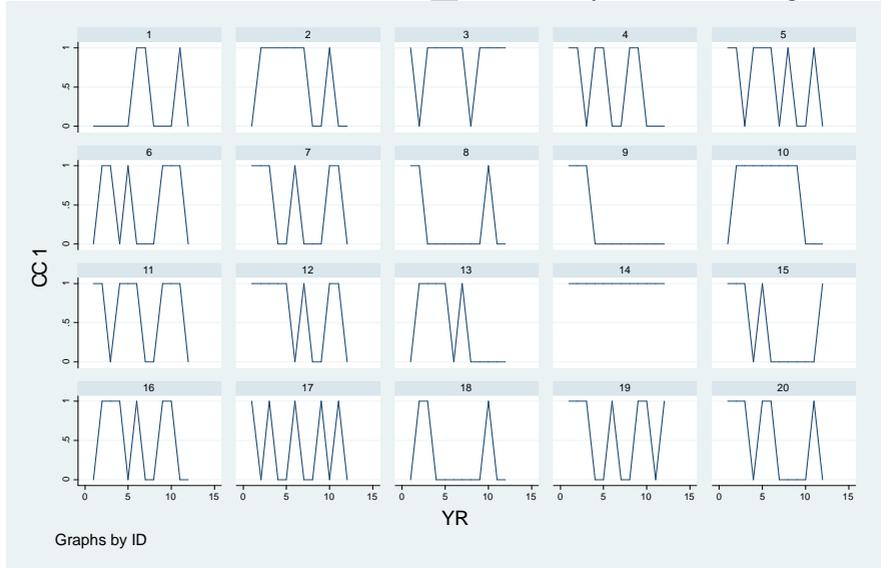

Figure 1: Currency crisis index for 20 emerging countries*

*The names of Countries by ID are: (1) Argentina (2) Brazil (3) Chile (4) Czech

Republic (5) Hungary (6) Indonesia (7) Jordan (8) Korea (9) Malaysia (10) Mexico (11) Morocco (12) Peru (13) Philippines (14) Poland (15) Russian Federation (16) Singapore (17) South Africa (18) Thailand (19) Trinidad and Tobago (20) Turkey.
Source: Author's calculations

A study by Krznar (2004) shows that the efficiency of this index in defining the years with a currency crisis is higher than the *Signals approach* used by Kaminsky, Lizondo & Reinhart (1998).

Capital controls

One primary limitation in the capital controls literature is the lack of a consistent measure of capital account liberalization. Capital controls can take several different forms, making it very difficult to track changes in restrictions within a country.

Furthermore, the construction of any index for capital controls creates an aggregation problem. By how much should an index drop if a country omits one of its many constrains on capital flows? Last, but not least, the efficiency of a capital controls index depends significantly on the government's ability and willingness to enforce them, which is almost impossible to be weighted in an index for capital controls.

In this study one of the most reliable and comprehensive indices in the literature, provided by the International Monetary Fund (IMF), is applied. This cumulated index is more convenient for studies including a panel of different countries. This index has 13 subcategories[2] which takes the value of 1 if there are controls and 0 otherwise, and is published in the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions* (*AREAER*). The subcategories in the capital control index are (1) capital market securities, (2) money market instruments, (3) collective investment securities, (4) derivatives and other instruments, (5) commercial credits, (6) financial credits, (7) guarantees, sureties, and financial backup facilities; (8) direct investment, (9) liquidation of direct investment, (10) real estate transactions, (11) personal capital movements, (12) provisions specific to commercial banks and other credit institutions; and (13) provisions specific to institutional investors (International Monetary Fund, 1999-2010).
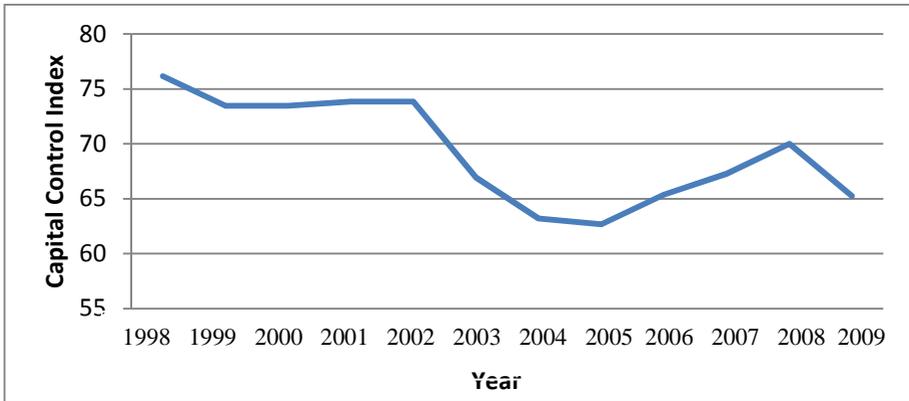
Figure 2: Capital control index trend for 20 emerging economies
Source: IMF, AREAER (different versions), Author's calculations.

As it is shown in Figure (2), the degree of controls on capital flows has decreases in the sample of 20 emerging countries of this study.

Trade openness index
While in most studies data for imports and exports of a country are applied to compile an index for the degree of trade openness, but in this study the Trade Openness score, which is one of the subcategories of Economic Freedom index of the Heritage Foundation, is applied. The data from this institute for trade freedom has been released since 1995. In this institute, tariff rates and non-tariff barriers are used to construct the trade freedom index.

Because of different imported goods to countries, there are different tariff rates. Therefore, they use a weighted average tariff and the weight for this is based on the share of imports for each good. The following equation is used to calculate the trade freedom index;

$$\text{Trade freedom}_i = \left(\left(\left(Tariff_{max} - Tariff_i\right)/\left(Tariff_{max} - Tariff_{min}\right)\right)*100\right) - NTB_i \quad (5)$$

Where Trade freedom$_i$ is the degree of trade openness in country *i*, Tariff$_{max}$ shows the upper bound and Tariff$_{min}$ shows the lower bound for the Tariff rates (%), Tariff$_i$ stands for the weighted tariff (average rate (%)) in country *i* and NTB$_i$ shows non-trade barriers in country *i* which is subtracted from the base score[3] (Heritage-Foundation, 2011).
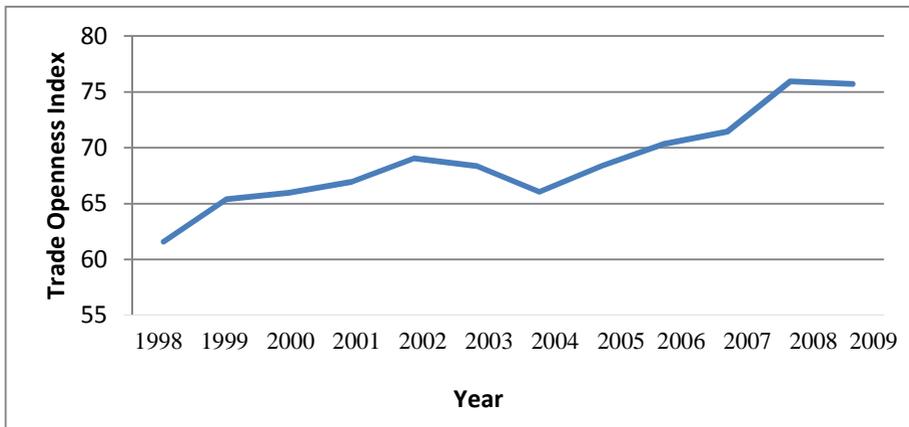
Figure 3: Trade openness index trend for 20 emerging economies

Source: Heritage Foundation (Different reports), Author's calculations.

As is shown in Figure (3), the degree of trade freedom in the sample of emerging economies in this study has increased by almost 10 index points during 1998-2009. Although, the increase in this index is an appropriate phenomenon and it increases the role of the economy in international markets and improves the trade balance of the country, in this study we have focused in the timing of trade liberalization compared to capital account liberalization.

Therefore, by using the above variables the model of this study can be specified as follows:

$$CC = f(CAC, DCG, CAGDP, RGDPG, CTOD) \tag{6}$$

Where CC shows the Currency Crises occurrence by a dummy variable which takes the value of one in the case of the existence of currency crises and zero otherwise, CAC is Capital Account Control index, DCG is Domestic Credit Growth, CAGDP is Current Account to GDP Ratio, RGDPG is Real GDP Growth and CTOD shows the Capital-Trade Openness Difference. The above equation is estimated by using A Probit Panel Data Framework (Greene 2012), and the results are shown in section V.

4. Data Sources

The data gathered for this study to build its panel data framework are

collected from various sources for 20 emerging economies including Argentina, Brazil, Chile, Czech Republic, Hungary, Indonesia, Jordan, Korea, Malaysia, Mexico, Morocco, Peru, Philippines, Poland, Russian Federation, Singapore, South Africa, Thailand, Trinidad and Tobago, Turkey for the period of 1998-2009. The data for the capital control index are from the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions* (*AREAER*) which has more complete information about the capital control subcategories since 1996 compared to previous reports. As mentioned in the last section, it has 13 subcategories where all of them are extracted from the 1999-2010 (as each volume provides the data for the previous year) report versions. The data for Trade Freedom are taken from *Heritage Foundation Economic Freedom Report 2011*.

The data for domestic credit growth are obtained from the IMF's *International Financial Statistics (IFS) 2010* by IFS line 52 and then divided by data in IFS line 64 to obtain the real terms for domestic credit. The same source is used for other explanatory variables, that is, IFS line 60 (deposit rate) is deflated by IFS line 64 (CPI) to be used for the real interest rate, the real exchange rate is adjusted by the relative consumer price index. The data for GDP and Current account are also used from IFS.

5. Empirical Results

The probability of a currency crisis for the sample of 20 emerging countries for the period of 1998-2009 is estimated, and the results are shown in the table. The associated value for Z is shown in a separate column. The nature of a binary dependent variable in this model which is the outcome of our index for a currency crisis, allows us to use a Probit Panel Data framework to estimate the parameters. All the variables in the model are statistically significant (at the 1% level of significance) and have the predicted sign. The capital control index has a negative impact on the occurrence of currency instability which means the higher the level of capital account liberalization the higher the probability of exchange rate instability. Although it was accepted by most academics in the last few decades that liberalizing capital movements have high benefits for emerging countries, the crises in East Asia and the spread of the Financial crises in the US to other countries in 2007-8 witnessed that it might create serious problems for these economies as well. As it is

mentioned in the literature review a high domestic credit growth is one potential element in a currency crisis, and the results from this study support this viewpoint.

The impact of the current account to GDP ratio is significant and it supports the theory which indicates that the higher the levels of the current account of countries the lower the probability of exchange rate instability.

Table 1: Panel Estimation Results for 20 Emerging Countries[*]

Variables	Probit Panel Data Framework		
	Coefficient	Z	P>|z|
Capital account control	-1.969	-2.70	0.007
Domestic credit growth	2.104	2.31	0.021
Current account to GDP ratio	-7.206	-3.01	0.003
Real GDP growth	-9.987	-2.50	0.012
Capital-Trade openness difference	.021	1.97	0.049
constant	.984	2.20	0.028
Log likelihood		-148.29305	
Wald chi2(5)		23.12	

[*] The results have been obtained by using **Stata12**.

The Wald test has been applied to check for Heteroscedasticity, indicating no problem.

Our control variable in this study, which is the difference between the degree of capital account liberalization and trade openness, has the predicted sign and is significant, which supports the idea of this study and it shows that if the degree of capital liberalization is higher than the level of trade freedom in our sample of emerging countries then it increases the probability of a currency crises. As mentioned in the last sections there is the possibility for these countries that a higher degree of trade liberalization compared to the level of capital liberalization, creates a higher probability of a currency attack.

6. Summary and Conclusion

This study has attempted to show the importance of trade liberalization as a prerequisite for capital account liberalization and as an important factor to decrease the risk of currency attack in emerging countries. We have used data for a sample of 20 emerging economies covering the period 1998-2009. As shown by the empirical results, there is a positive and significant relationship between the degree of capital liberalization compared to trade freedom and the probability of currency crises for the sample of countries used in this study. Indeed, the higher the difference between the capital account liberalization index and the trade openness index, the higher the probability of an exchange rate attack. This shows that it is not just that the process of capital account liberalization must be conducted in an appropriate way, but also the sequencing of trade liberalization and capital account liberalization is important and affects the vulnerability of the country against domestic and foreign shocks.

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Notes:

1. Both Probit and Logit structures are popular and consistent to be used for a binary dependent variable in the literature and "in most applications, the choice between these two seems not to make much difference"(Greene, 2012, p. 689). However, due to the constrained variations in the explanatory variables of this study which is more similar to the Probit's Cumulative Distribution Function (CDF), the Probit model is selected.

2. In the pre-1996 editions of *AREAER,* there was only six separate categories including bilateral payments arrangements with members and nonmembers, restrictions on payments for current account transactions, restrictions on payments for capital account transactions, import surcharges, advance import deposits, and surrender or repatriation requirements for export proceeds.

3. "The penalty of 5, 10, 15, or 20 points is assigned according to the following scale:

20—NTBs are used extensively across many goods and services and/or act to effectively impede a significant amount of international trade.

15—NTBs are widespread across many goods and services and/or act to impede a majority of potential international trade.

10—NTBs are used to protect certain goods and services and impede some international trade.

5—NTBs are uncommon, protecting few goods and services, and/or have very limited impact on international trade.

0—NTBs are not used to limit international trade."Heritage-Foundation (2009), *Economic Freedom Report*, http://www.heritage.org/index/Trade-Freedom
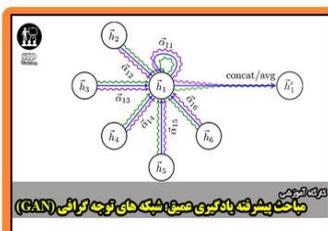
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