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Labor market flexibility and the real exchange rate

Qingyuan Du [a,*], Qing Liu [b,1]

[a] Department of Economics, Monash University, 900 Dandenong Road, Building H, Room 4.49, Caulfield East, 3145, Australia
[b] School of Economics and Management, Tsinghua University, Beijing, 10084, China

HIGHLIGHTS

- We analyze how labor market flexibility affects the real exchange rate (RER).
- A more flexible labor market leads to a lower RER.
- Changes in labor market conditions can yield significant changes in the RER.

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ABSTRACT

This paper studies how labor market flexibility can affect the real exchange rate. Both theoretically and empirically, we find that a more flexible (rigid) labor market is associated with a lower (higher) real exchange rate.

1. Introduction

The real exchange rate, one of the most important relative prices, has caused many debates in the world. To our knowledge, the current understandings of the determinant of the real exchange rate are far from complete. None of the papers in the literature have considered the role of labor market conditions. In this paper, we aim at filling this void and analyzing how labor market flexibilities can affect the real exchange rate.

We first build a theoretical model to analyze the relationship between labor market flexibility and the real exchange rate. In presence of the firm-level shocks, a country with a flexible labor market can reallocate labor across firms more easily than a country with a rigid labor market. This implies that more productive firms can take larger market shares. As a result, the country with a flexible labor market is associated with a higher average productivity, which in turn leads to a lower final good price and hence, a lower real exchange rate.

Using two measures for the labor market flexibilities (one from Global Competitiveness Report and the other from Doing Business Report (see Tables 1 and 2)), we provide cross-country empirical support to our theory. How important is the effect of labor market flexibility on the real exchange rate? As an application from our regression results, we consider one experiment: if a country with a rigid labor market such as Portugal improves its labor market flexibility to the level of Hong Kong (an economy with a flexible labor market), while keeping everything else constant, its real exchange rate will decline by around 15%–20%.

The rest of the paper is organized as follows. In Section 2, we build a model to illustrate the mechanism through which a more flexible labor market is associate with a lower real exchange

* Corresponding author. Tel.: +61 3 99034702.
E-mail addresses: qingyuan.du@monash.edu (Q. Du), liuqing@sem.tsinghua.edu.cn (Q. Liu).
[1] Tel.: +86 10 62773994.

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Table 1
Ten countries with the most flexible labor markets.

Country	GCR index	Country	DBR index
Denmark	6	Singapore	100
Singapore	5.8	Hong Kong	100
Switzerland	5.5	United States	100
Georgia	5.4	Maldives	100
Hong Kong	5.4	Marshall Islands	100
Kazakhstan	5.4	Australia	97
United States	5.4	Canada	96
Iceland	5.3	Jamaica	96
Azerbaijan	5.2	Palau	96
Nigeria	5.2	Georgia	93

Table 2
Ten countries with the most rigid labor markets.

Country	GCR index	Country	DBR index
Italy	2.1	Congo, the Dem Rep	22
Suriname	2.1	Guinea-Bissau	23
Venezuela	2.1	Niger	23
Namibia	2.2	Venezuela	24
Germany	2.3	Bolivia	26
South Africa	2.3	Central African Rep	27
Bolivia	2.5	Congo	31
France	2.5	Tanzania	33
Portugal	2.5	Sao Tome and Principe	33
Zimbabwe	2.5	Equatorial Guinea	34

rate. Section 3 presents the empirical evidence. Section 4 provides concluding remarks.

2. Model

We consider a small open economy Home which is endowed with $\bar{L}$ units of labor. Assume that labor is internationally immobile. For simplicity, we do not assume any dynamics in the model.[2] Consumers spend all their incomes on a final good. The final consumption good consists of two parts: tradable and non-tradable

$$C = \frac{C_T^{\gamma} C_N^{1-\gamma}}{\gamma^{\gamma} (1-\gamma)^{1-\gamma}} \tag{2.1}$$

where C_T and C_N denote the aggregate tradable and non-tradable good indices, respectively. We normalize the aggregate world tradable good price to be one. The national CPI is

$$P = P_N^{1-\gamma}. \tag{2.2}$$

The final tradable good is produced by a continuum of intermediate tradable goods from producers all over the world. For an intermediate tradable good producer i in Home, the demand curve is

$$y_T^D (i) = \xi \left(p_T (i)\right)^{-\varepsilon_T} \tag{2.3}$$

where ξ is a constant which captures the world demand conditions and $y_T^D (i)$ represents the individual demand for firm i's good in the tradable good sector.[3] ε_T (> 1) denotes the elasticity of substitution between any tradable intermediate goods. Every intermediate tradable good producer uses a linear technology

$$y_T^S (i) = e^{\pi_T^i} L_T (i) \tag{2.4}$$

where π_T^i represents the productivity shock and $y_T^S (i)$ represents firm i's supply in the tradable good sector. In this paper, we assume that π_T is drawn from an i.i.d. distribution with mean 0 and variance σ_T^2, and we use $G_T (\cdot)$ denote its distribution function.

The final non-tradable good in Home is produced by a continuum of intermediate goods according to the technology

$$C_N = \left[\int_0^1 y_N (j)^{\frac{\varepsilon_N - 1}{\varepsilon_N}} dj\right]^{\frac{\varepsilon_N}{\varepsilon_N - 1}} \tag{2.5}$$

where intermediate goods are gross substitutes, i.e., $\varepsilon_N > 1$. In this case, the demand for each intermediate good j $\left(y_N^D (j)\right)$ is

$$y_N^D (j) = \left(\frac{p_N (j)}{P_N}\right)^{-\varepsilon_N} C_N. \tag{2.6}$$

For simplicity, we also assume that each non-tradable intermediate good is produced with labor only:

$$y_N^S (j) = e^{\pi_N^j} L_N (j) \tag{2.7}$$

where π_N^j is another stochastic term with mean 0 and variance σ_N^2, and $y_N^S (j)$ represents firm j's supply in the non-tradable good sector. We use $G_N (\cdot)$ denote the distribution function of π_N^j.

In equilibrium, markets clear in both tradable and non-tradable good sectors, $y_T^D (i) = y_T^S (i)$ and $y_N^D (j) = y_N^S (j)$.

2.1. Flexible labor market

We first analyze one extreme case that Home has a fully flexible labor market. Similar to Cunat and Melitz (2012), in this case, all markets are competitive, the determination of all prices and the allocation of all resources take place after the realization of π s. This captures the idea that a flexible economy can costlessly reallocate resources towards their most efficient use. For simplicity, we assume *ex ante* free entry in both tradable and non-tradable intermediate good sectors. Then, all intermediate good producers earn zero profits. As a result, for firm i in the tradable good sector and firm j in the non-tradable good sector, prices are

$$p_T^{flex} (i) = \frac{w^{flex}}{e^{\pi_T^i}} \quad \text{and} \quad p_N^{flex} (j) = \frac{w^{flex}}{e^{\pi_N^j}} \tag{2.8}$$

where w^{flex} denotes the equilibrium wage rate in Home.

For simplicity, we assume $\varepsilon_T = \varepsilon_N \equiv \varepsilon > 1$ and $G_T = G_N \equiv G$ in the rest of this paper.[4] Then the aggregate price index for the non-tradable good is

$$P_N^{flex} = \left[\int_{-\infty}^{+\infty} \left(\frac{w^{flex}}{e^{\pi}}\right)^{1-\varepsilon} dG (\pi)\right]^{\frac{1}{1-\varepsilon}}. \tag{2.9}$$

In online Appendix A, we can show that

$$P^{flex} = \left(P_N^{flex}\right)^{1-\gamma} = \left(\frac{\xi}{\gamma \bar{L}}\right)^{\frac{1-\gamma}{\varepsilon}} \left(\frac{1}{\tilde{\pi}}\right)^{\frac{1-\gamma}{\varepsilon}} \tag{2.10}$$

where

$$\tilde{\pi} = \left[\int_{-\infty}^{+\infty} e^{\pi(\varepsilon-1)} dG (\pi)\right]^{\frac{1}{\varepsilon-1}}$$

represents the aggregate productivity level among all intermediate good producers in the non-tradable good sector when the labor market is fully flexible.

[2] We consider the equilibrium in our model as the long-run steady state in a dynamic model.

[3] This assumption means that the rest of world is in an equilibrium, therefore, the aggregate demand is a constant.

[4] Relaxing this assumption does not change any of the qualitative results.

2.2. Rigid labor market

We now consider another special case that Home has a fully rigid labor market. As in Cunat and Melitz (2012), intermediate-good producers must hire workers before the realization of πs. No labor adjustment is allowed thereafter. This corresponds to the idea that rigidities prevent producers from adjusting to changing circumstances. Given that all producers within the same sector (tradable or non-tradable) are *ex ante* identical, they will make the same employment decision.[5] For a representative intermediate tradable good producer, the *ex ante* zero-profit condition is

$$w^{rigid} L_T^{rigid} = \int_{-\infty}^{+\infty} p_T^{rigid}(i)\, y_T^{rigid}(i)\, dG\left(\pi_T^i\right). \tag{2.11}$$

The market clearing condition for good i is

$$e^{\pi_T^i} L_T^{rigid}(i) = \xi \left(p_T^{rigid}(i)\right)^{-\varepsilon}. \tag{2.12}$$

By (2.11) and (2.12), the labor input by the producer i is

$$L_T^{rigid}(i) = \xi \left(w^{rigid}\right)^{-\varepsilon} \hat{\pi}^{\varepsilon-1} \tag{2.13}$$

where

$$\hat{\pi} = \left[\int_{-\infty}^{+\infty} e^{\pi(1-1/\varepsilon)} dG(\pi)\right]^{\frac{1}{1-1/\varepsilon}}$$

represents the aggregate productivity level among all intermediate good producers in the non-tradable good sector when labor market is rigid.

For a representative intermediate non-tradable good producer, the *ex ante* zero-profit condition is

$$w^{rigid} L_N^{rigid} = \int_{-\infty}^{+\infty} p_N^{rigid}(j)\, y_N^{rigid}(j)\, dG\left(\pi_N^j\right). \tag{2.14}$$

The market clearing condition for good i is

$$e^{\pi_N^j} L_N^{rigid} = \left(\frac{p_N^{rigid}(j)}{P_N^{rigid}}\right)^{-\varepsilon} C_N^{rigid} \tag{2.15}$$

where the aggregate non-tradable good price index P_N^{rigid} is

$$P_N^{rigid} = \left[\int_{-\infty}^{+\infty} p_N^{rigid} \left(\pi_N^j\right)^{1-\varepsilon} dG\left(\pi_N^j\right)\right]^{\frac{1}{1-\varepsilon}}. \tag{2.16}$$

In this case, we show in online Appendix B that, Home CPI is

$$P^{rigid} = \left(P_N^{rigid}\right)^{1-\gamma} = \left(\frac{\xi}{\gamma \bar{L}}\right)^{\frac{1-\gamma}{\varepsilon}} \left(\frac{1}{\hat{\pi}}\right)^{\frac{1-\gamma}{\varepsilon}}. \tag{2.17}$$

We compare the outcomes under the two labor market conditions (fully flexible labor market and fully rigid labor market). Two remarks are in order. First, a flexible labor market is associated with a higher aggregate productivity in the non-tradable good sector. Here is the intuition. With a flexible labor market, workers freely flow towards more productive intermediate good producers, while such re-allocation process is constrained when a country has a rigid labor market. Hence, a flexible labor market yields a higher aggregate productivity. Second, the aggregate price level of the non-tradable good is lower in a country with a flexible labor market. This is because more productive producers are also with lower prices, and flexible labor market yields a greater share of those producers in the non-tradable good sector.

2.3. Labor market flexibility and the real exchange rate

In general, a country's labor market lies in between the two extreme cases (fully flexible labor market and fully rigid labor market). In this paper, we simply use parameter θ denote the labor market flexibility in Home. We assume that, in both tradable and non-tradable good sectors, a fraction θ of intermediate good producers can flexibly adjust labor inputs while a fraction $1-\theta$ of those producers cannot adjust labor inputs after signing a contract with workers.

We show in online Appendix C that, Home CPI in this case is

$$P = \left(\frac{\xi}{\gamma \bar{L}}\right)^{\frac{1-\gamma}{\varepsilon}} \left(\frac{1}{\pi(\theta)}\right)^{\frac{1-\gamma}{\varepsilon}} \tag{2.18}$$

where

$$\pi(\theta) = \left[\theta \tilde{\pi}^{\varepsilon-1} + (1-\theta)\hat{\pi}^{\varepsilon-1}\right]^{\frac{1}{\varepsilon-1}}.$$

Let P^* be the CPI in the rest of world (which is a constant due to the small Home economy assumption). Then Home's real exchange rate is

$$RER_H = \frac{P}{P^*}.$$

For technical simplicity, we parametrize the productivity shocks to the normal distribution, thus assuming that $\pi \sim N\left[0, \sigma^2\right]$. Then we can show the following proposition.

Proposition 1. *If $\pi \sim N\left[0, \sigma^2\right]$, as Home's labor market becomes more flexible, i.e., θ increases, the real exchange rate of Home will decline.*

Proof. See online Appendix D.

The intuition behind Proposition 1 is as follows. As in the previous analysis, as labor market rigidity rises, it is harder for workers flowing towards more productive producers, which in turn yields a lower aggregate productivity and a higher aggregate price level in the non-tradable good sector. Due to the small open economy assumption, the aggregate tradable good price is exogenous. As a result, a rise in a country's labor market rigidity raises its CPI level and hence, the real exchange rate appreciates.

3. Empirical evidence

We now investigate the empirical relationship between labor market flexibility and the real exchange rate. Our specification is the following:

$$\log RER_i = \alpha + \beta \cdot labor.market.flexibility + X_i \Gamma + \varepsilon_i$$

where $\log RER_i$ refers to country i's real exchange rate in logarithm. *labor.market.flexibility* is the index of country i's labor market flexibility. X_i represents other possible determinants of the real exchange rate, including GDP per capita, government expenditure to GDP ratio, financial market development, terms of trade, tariff, and nominal exchange rate regimes.

[5] We adopt such assumption to simplify the algebra. Since the model focuses on the steady state, this assumption leads to *ex post* misalignment between labor and productivity in the steady state, which captures a similar outcome caused by labor market rigidity. Having all firms in the same sector making the same labor choice is not a necessary condition to derive our qualitative results. In a more general model, for instance, we may assume that a firm's productivity consists of two parts: its long-run (non-stochastic) productivity and an idiosyncratic shock. Firms can differ in their long-run productivity levels. In this case, the optimal choices by firms may lead to different employment decisions across firms. The qualitative results, however, remain unchanged.

Table 3
Summary statistics, averaged over 2004–2008.

Variable	Mean	Median	Standard deviation	Min value	Max value
Ln(RER)	−0.55	−0.59	0.39	−1.51	0.49
Labor market flexibility (GCR)	3.83	3.8	0.83	2.1	6
Labor market flexibility (DBR)	63	63	19	22	100
GDP per capita	12 443	6299	15 067	320	86 365
Government expenditure (% of GDP)	25	23	11	0.24	70
Financial market development	51	35	48	2.43	229
Tariff	6.96	5.47	5.38	0	30
Terms of trade	110	101	30	26	201

3.1. Data description

We start with data for 120 economies over the period from 2004 to 2008. Since our theory is about the equilibrium real exchange rate, we compute the five year average over the period 2004–2008 for each variable. The summary statistics for the main variables of interest are presented in Table 3.

The real exchange rate data can be obtained from Penn World Table 7 (PWT 7) database. Using the PWT 7 definition, an increase in the value of the real exchange rate means an appreciation. In Table 3, the log(real exchange rate) varies from −1.51 to 0.49. The mean value is −0.59, which implies that the mean value of the real exchange rate is 59% below the absolute purchasing power parity (PPP).

The key regressor in the regression is the labor market flexibility index. We use two indices in this paper. The first labor market flexibility index is from The Global Competitiveness Report (GCR). The Global Competitiveness report has done surveys on how executives regarding business conditions in their countries annually. One of the questions asked is whether the hiring and firing of workers is impeded by regulations or flexibly determined by employers. Responses are given on a scale from 1 to 7, with a higher score reflecting a higher degree of labor market flexibility. We use the responses to this question to construct an index of the flexibility of the labor market. Due to the data availability, we use the index from the 2008 report.

The second labor market flexibility index is from the Doing Business Report (DBR), which is done by the World Bank. Following Botero et al. (2004), the World Bank has collected measures which capture the rigidities of employment laws across countries. A weighted index is then computed by weighing three measures of rigidities: hiring costs, firing costs and restrictions on changing the working hours. The index takes value from 0 to 100, with a higher values reflecting a higher degree of labor market rigidity. In this paper, we subtract the variable from 100 to generate a measure of labor market flexibility. One potential disadvantage of this measure is that the enforcement of legal rules may vary across countries, which may affect the estimation results. Fig. 1 shows the scatter plot of the two labor market flexibility indices. As we can see, although there exists a clearly positive correlation between the two indices, they are still different from each other. For instance, New Zealand is one of the countries with the most flexible labor markets according to the DBR measure, however, its labor market flexibility measure from GCR measure is lower than the median. In this paper, we use the two measure to test how labor market flexibility affects the real exchange rate level.

We also include other control variables that may potentially affect the real exchange rate in the regressions. We include log(GDP per capita) to control for the Balassa–Samuelson effect, where GDP per capita data is obtained from PWT 7 database. We include the government expenditure to GDP ratio to control for the Froot–Rogoff effect, which can be obtained from World Bank database. We also control for the potential effect of the financial market development, terms of trade and trade barriers on the real exchange rate. We use the credit to private sector (% of GDP) as a proxy to the financial market development. The data, as well as the tariff and terms of trade data, can also be obtained from World Bank database. Since the real exchange rate in major oil exporters may move differently from other countries, we also include the major oil exporter dummy in some of the regressions. One may also concern that, the nominal exchange rate regimes might also affect the real exchange rate level. In our empirical studies, we use two *de facto* exchange rate regime classifications, Reinhart and Rogoff classification and Levy-Yeyati and Sturzenegger classification, to control the effect from nominal exchange rate regimes.

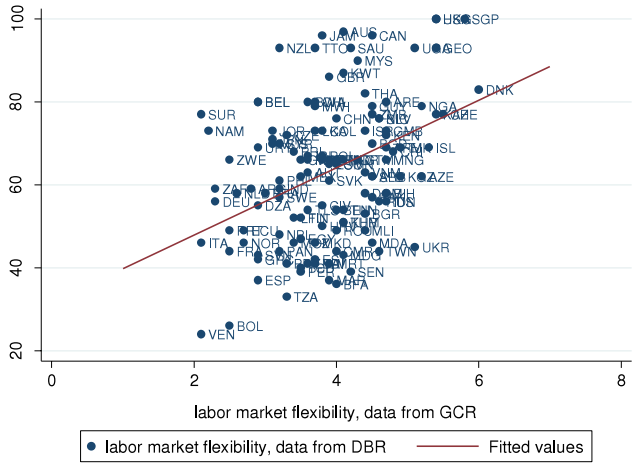

Fig. 1. Two labor market flexibility indices, DBR vs. GCR.

3.2. Results

Table 4 shows the OLS regression results by using the GCR labor market flexibility measure. In Column (1), the regressors are labor market rigidity, log(country's income) (to control for the Balassa–Samuelson effect), government expenditure (to control for the Froot–Rogoff effect) and financial development index. We can see that the coefficient on the labor market flexibility is negative and significant, which means that, as labor market becomes more flexible, the country's real exchange rate declines. In fact, according to the regression results in Column (1), such effect is quantitatively large. For instance, consider one experiment that, if Portugal increases its labor market flexibility (2.5) to the same level of Hong Kong (5.4), the real exchange rate will decline by around 20%.

In Column (2), we include two other variables, tariff and terms of trade, in the regression. We obtain similar results as in Column (1). Since major oil exporters' real exchange rate may move differently as other countries, in Column (3), we report the regression result by adding a dummy of the major oil exporters. We find that, the coefficient on the labor market flexibility is still negative and statistically significant. In the last two columns, we control for the nominal exchange rate regime effect by

Table 4
ln(RER) vs. labor market flexibility (global competitiveness report index).

	(1)	(2)	(3)	(4)	(5)
Labor market flexibility	−0.069**	−0.071**	−0.069**	−0.053*	−0.057*
	(0.029)	(0.030)	(0.030)	(0.030)	(0.030)
ln(GDP per capita)	0.159**	0.143**	0.139**	0.157**	0.168**
	(0.027)	(0.032)	(0.032)	(0.036)	(0.036)
Government expenditure (% of GDP)	0.003	0.003	0.003	0.005*	0.004
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Financial market development	0.003**	0.003**	0.003**	0.002**	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Tariff		−0.005	−0.006	0.005	0.004
		(0.008)	(0.008)	(0.009)	(0.009)
ln(terms of trade)		0.089	0.051	−0.028	0.049
		(0.115)	(0.126)	(0.128)	(0.132)
Major oil exporters			0.092	0.095	0.035
			(0.124)	(0.131)	(0.129)
Crawling peg (RR)				−0.136**	
				(0.062)	
Managed floating (RR)				0.077	
				(0.068)	
Free floating (RR)				0.137	
				(0.104)	
Intermediate (LYS)					−0.071
					(0.065)
Float (LYS)					−0.070
					(0.056)
Observations	105	104	104	96	99
R-squared	0.70	0.71	0.71	0.75	0.73

Standard errors in parentheses.
* $p < 0.1$.
** $p < 0.05$.

Table 5
ln(RER) vs. labor market flexibility (doing business report index).

	(1)	(2)	(3)	(4)	(5)
Labor market flexibility	−0.003*	−0.003*	−0.003*	−0.003*	−0.002
	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)
ln(GDP per capita)	0.104**	0.102**	0.100**	0.103**	0.113**
	(0.032)	(0.035)	(0.037)	(0.037)	(0.039)
Government expenditure (% of GDP)	0.007**	0.007**	0.008**	0.008**	0.006*
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
Financial market development	0.004**	0.004**	0.004**	0.003**	0.004**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Tariff		0.001	0.001	0.004	0.001
		(0.006)	(0.006)	(0.006)	(0.006)
ln(terms of trade)		0.047	0.038	−0.018	0.046
		(0.101)	(0.109)	(0.105)	(0.113)
Major oil exporters			0.030	0.158	0.002
			(0.127)	(0.135)	(0.132)
Crawling peg (RR)				−0.187**	
				(0.061)	
Managed floating (RR)				0.073	
				(0.071)	
Free floating (RR)				0.188	
				(0.104)	
Intermediate (LYS)					0.105
					(0.072)
Float (LYS)					0.097
					(0.062)
Observations	116	114	114	104	109
R-squared	0.63	0.63	0.63	0.70	0.64

Standard errors in parentheses.
* $p < 0.1$.
** $p < 0.05$.

including two *de facto* exchange rate regime classifications (Reinhart and Rogoff classification and Levy-Yeyati and Sturzenegger classification) in the regressions. The results do not change much.

In Table 5, we use the labor market rigidity index from DBR in the regressions. As we can see, in first four regressions (Column (1) to Column (4)), the coefficients on the labor market flexibility are negative and statistically significant. In the last column when we use the Levy-Yeyati and Sturzenegger exchange rate regime classification, we can still obtain a negative coefficient on the labor market flexibility, however, it is not statistically significant. Quantitatively, we consider the same experiment that Portugal improves its labor market flexibility (49) to the same level of Hong Kong (100), by Column (1) in Table 5, its real exchange rate

will decline by more than 15%. The change again is economically significant.

More generally, when we consider the quantitative effect of the labor market flexibility on the real exchange rate, if the labor market flexibility increases by one standard deviation, two indices both suggest that, the real exchange rate will decline by around 6%. This implies that, our results are both empirically and economically robust.

4. Concluding remarks

We study how labor market flexibility can affect the real exchange rate in this paper. We find that, theoretically, a more flexible labor market can lead to a lower value of the real exchange rate. We also provide cross-country empirical evidence to support the theory. Data suggests that, as a country improves its labor market flexibility, its real exchange rate will decline significantly.

Appendix A. Supplementary data

Supplementary material related to this article can be found online at http://dx.doi.org/10.1016/j.econlet.2015.08.012.

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