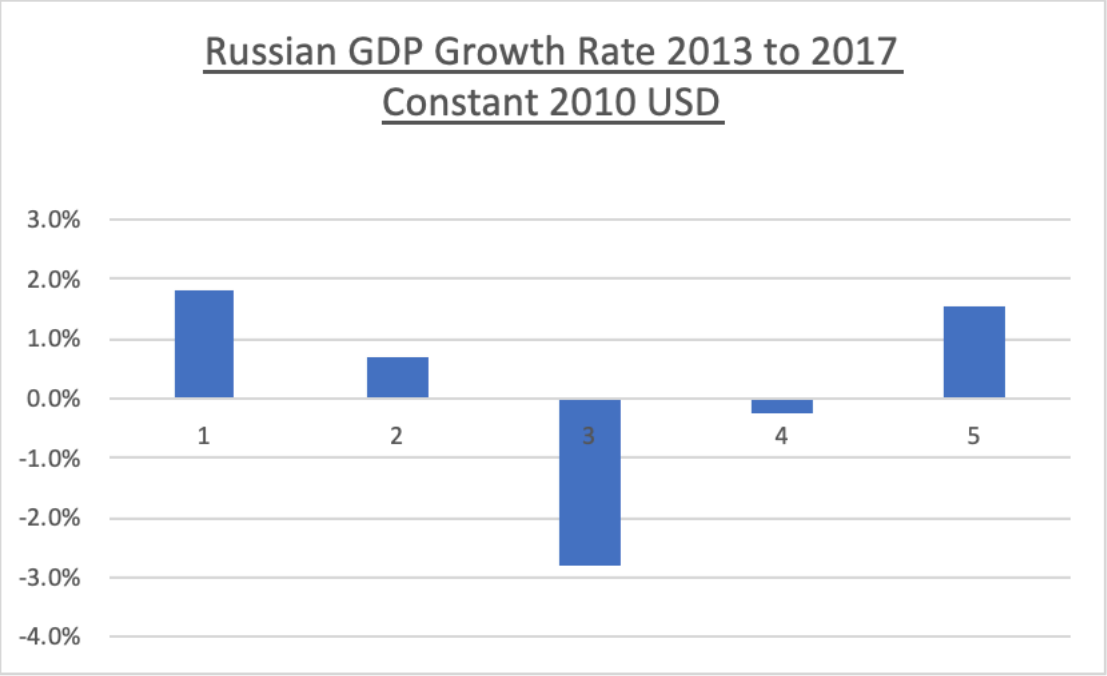
Macro Economics Environment Analysis
Russia 2019

1. Our target market is Russia; GDP data for the past five years is shown in the table below:

GDP Russia 2012 to 2017 Constant 2010 USD (latest available data, World Bank)
(in trillions USD)

Period	Year	GDP Trillions USD	In Billions USD	Change to Prior Year In Billions USD	% Change to Prior Year
0	2012	1.664	1,664		
1	2013	1.694	1,694	30	1.8%
2	2014	1.706	1,706	12	0.7%
3	2015	1.658	1,658	-48	-2.8%
4	2016	1.654	1,654	-4	-0.2%
5	2017	1.680	1,680	26	1.6%

https://data.worldbank.org/indicator/NY.GDP.MKTP.KD?locations=RU



According to the "Solow Residual" or "Total Factor Productivity" (TFP) formula derived in class:[1]

$$TFP = G_Y - (S_K \times G_K + S_L \times G_L)$$

Where:

Y=Output
G_Y = Growth in output
S_K = Share of capital
G_K = growth of capital
S_L = Share of labor
G_L= Growth of labor

TFP = Growth in Output - (Share of Capital X Growth of Capital + Share of Labor X Growth of Labor)

[1] Sussman, Oren; Lecture 2: Growth and Productivity, Saïd School of Business, Oxford, March 2019 (Sussman, 2019).

Using the data in the table below,

Period	Year	GDP Y $(000,000s)	G_Y ($\Delta Y/Y$) as Decimal	Gross Capital Formation K $(000,000s)	ΔK	G_K ($\Delta K/K$)	S_K (K/GDP)	Labor (People) L	Labor People L (000,000s)	G_L ($\Delta L/L$)	S_L ($1-S_K$)
0	2012	1,664,000		465,961			0.3	76,800,194	76.8		0.7
1	2013	1,694,000	0.018029	440,095	-25,866	-0.055511	0.3	76,521,071	76.5	-0.003634	0.7
2	2014	1,706,000	0.007084	413,421	-26,674	-0.060610	0.2	76,349,070	76.3	-0.002248	0.8
3	2015	1,658,000	-0.028136	358,029	-55,392	-0.133984	0.2	76,288,744	76.3	-0.000790	0.8
4	2016	1,654,000	-0.002413	363,516	5,487	0.015326	0.2	76,202,012	76.2	-0.001137	0.8
5	2017	1,680,000	0.015719	390,369	26,853	0.073870	0.2	75,638,703	75.6	-0.007392	0.8

https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=RU

where:

$G_Y = \Delta Y/Y$

ΔY= Ycurrent - Y last year

$G_K = \Delta K/K$

$G_L = \Delta L/L$

$S_L = 1 - S_K$

S_K=Capital/GDP

plugging the required values into the TFP equation $TFP = G_Y - (S_K \times G_K + S_L \times G_L)$ yields the following value for TFP for 2013:

TFP for 2013 = .018029 – [(.3 x - .055511) + (.7 x -.003634)]

= .0372

The amount of growth in output due to an increase in TFP was 3.7 %. Or, in other words, the amount of growth in output not due to an increase in capital or labor, which may be viewed as the residual increase in GDP that is unexplained by any increase in capital or labor, increased by 3.7%.

Using Excel to calculate the figures more precisely yields the following:[2]

[2] The decimals for share of labor and share of capital have been expanded out to the right of the decimal in order to obtain more precise figures.

Total Factor Productivity Russia

$TFP = G_Y - (S_K \times G_K + S_L \times G_L)$

Period	Year	TFP as Decimal	TFP as Pecentage
1	2013	0.0351	3.51%
2	2014	0.0235	2.35%
3	2015	0.0014	0.14%
4	2016	-0.0049	-0.49%
5	2017	0.0042	0.42%

TFP decreased as the country experienced a recession with declining GDP, declining foreign investment, declining gross capital formation and a lack of access to Western capital markets.[3]

As the economy began to recover in 2017, so did TFP.

[3]Economic sanctions that cut off access to Western capital were imposed for the invasion of Crimea in March 2014. Both the absolute value of capital used and the quantity of labor used in GDP decreased, but the absolute value of capital decreased more than that absolute value of labor. For example, gross capital formation shrank by 5.5%, 6% and 13% in 2013, 2014 and 2015 while the quantity of labor shrank by .3%, .2% and less than .01% respectively. The share of capital decreased to 20% and the share of labor increased to 80% (from 30% and 70% respectively) as GDP shrank by 2.8% in 2015. In the recovery period 2016 and 2017, the absolute value of gross capital formation increased by 1.5% and 7.5% respectively while the quantity of labor continued to decrease (by .1% and .7%). TFP remained negative or low at -.49% and .42%. This shows that capital formation and capital productivity were more important as a driver of GDP than either labor or TFP and why access to capital was a primary driver of growth of GDP in Russia. Or in other words, why Western sanctions that cut off access to capital matter.

2.

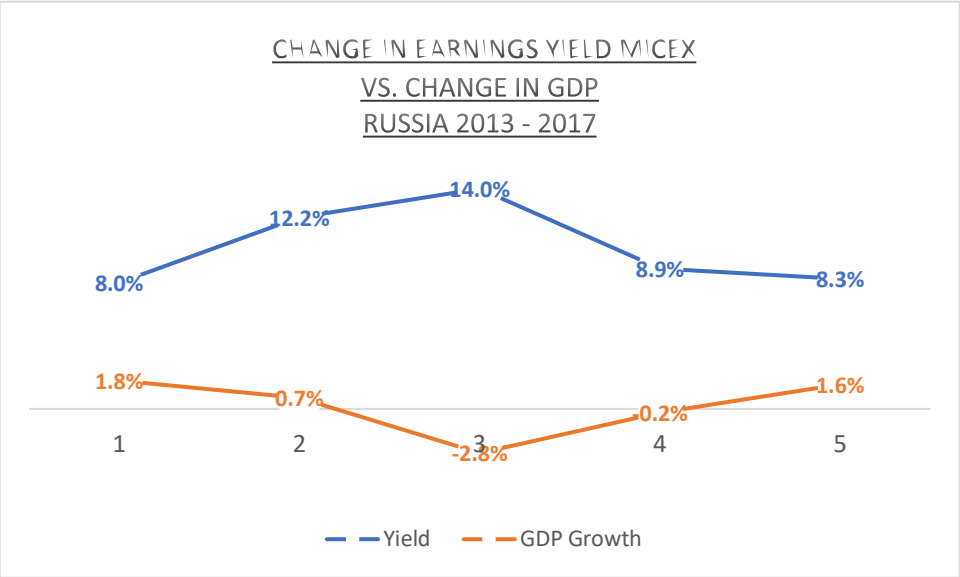
Table: Earnings Yield Russian Domestic Stock Market 2013 - 2017

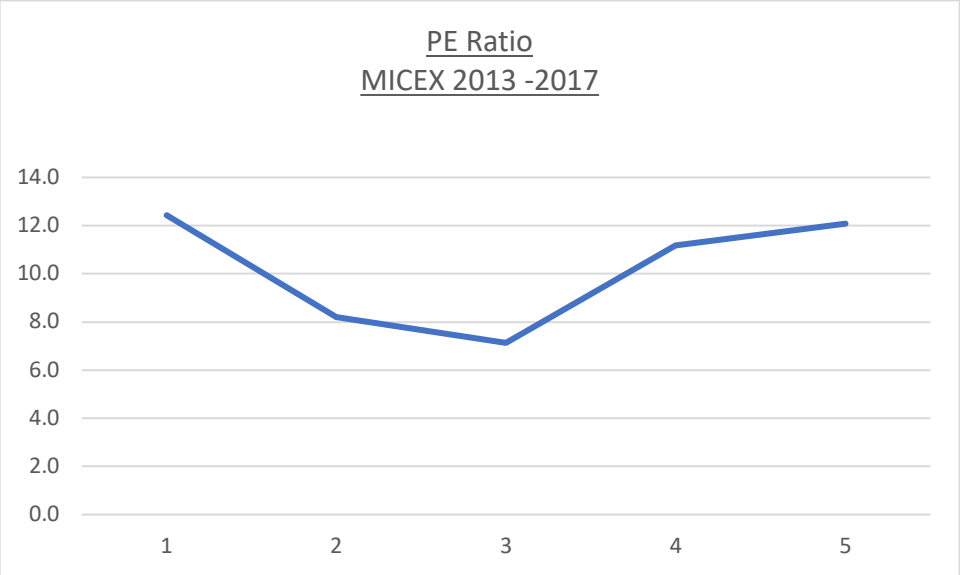
Moscow Stock Exchange
(MICEX/MOEX)

Period	Year	PE Ratio	Earnings Yield (1/PE Ratio)
1	2013	12.43	8.05%
2	2014	8.19	12.21%
3	2015	7.13	14.03%
4	2016	11.19	8.94%
5	2017	12.08	8.28%

Source: https://markets.businessinsider.com/stocks/moscow_exchange/financials

Plotting the earnings yield to the percentage change in GDP reveals an inverse relationship between the earnings yield and the percentage change in GDP. When GDP decreases, the yield rises and when GDP increases the yield falls. As the yield is the inverse ratio of the Price-to-Earnings Ratio (PE ratio), this means that when GDP fell, so did the price of equities in relation to their earnings.





Supply side models theorize that stock market returns are based on the underlying performance of firms in a market which translate into GDP growth. That is, higher profits (aggregate earnings) are a function of real growth in the economy that translate into higher earnings per share which translate into higher stock prices. The theory makes several assumptions which are subject to questioning[4]. However, if the theory is correct, then there should be a positive and direct correlation between increases in GDP and prices of domestic equities. (MSCI Barra, 2010).

[4] Assumptions: "the share of company profits in the total economy remains a constant; investors have a claim on a constant proportion of those profits; valuation ratios are constant; the country's stock market only lists domestic companies; the country's economy is closed" (MSCI Barra, 2010).

In looking at the data, the price of equities did positively correlate with GPD: the prices of equities dropped with a drop in GDP and rose when GDP rose. The earnings yield of the domestic stock market is broadly compatible with the performance of GDP in the Russia economy from the period 2013 – 2017 as predicted by supply side theory (Miles, et al., 2012).

3. Increase in the Consumer Price Level in Russia over the past five years:

Consumer Price Index Inflation
Russian Federation
2012-2017
2010 = 100

Period	Year	CPI Level	% change to prior year	Average
0	2012	113.94		
1	2013	121.64	6.8%	
2	2014	131.15	7.8%	
3	2015	151.52	15.5%	
4	2016	162.20	7.0%	
5	2017	168.17	3.7%	**8.2%**

Source: https://data.worldbank.org/indicator/FP.CPI.TOTL?locations=RU

As the data show, inflation in Russia over the past five years has ranged from 3.7% to 15.5% and has averaged 8.2% per year. From 2013 to 2017 the CPI increased by 38% from 121.64 to 168.17.

Below is a table of interest rates for Russia from 2013 to 2017 as listed by the Central Bank of Russia and other sources.:

Interest Rates
Russian Federation
2012-2017

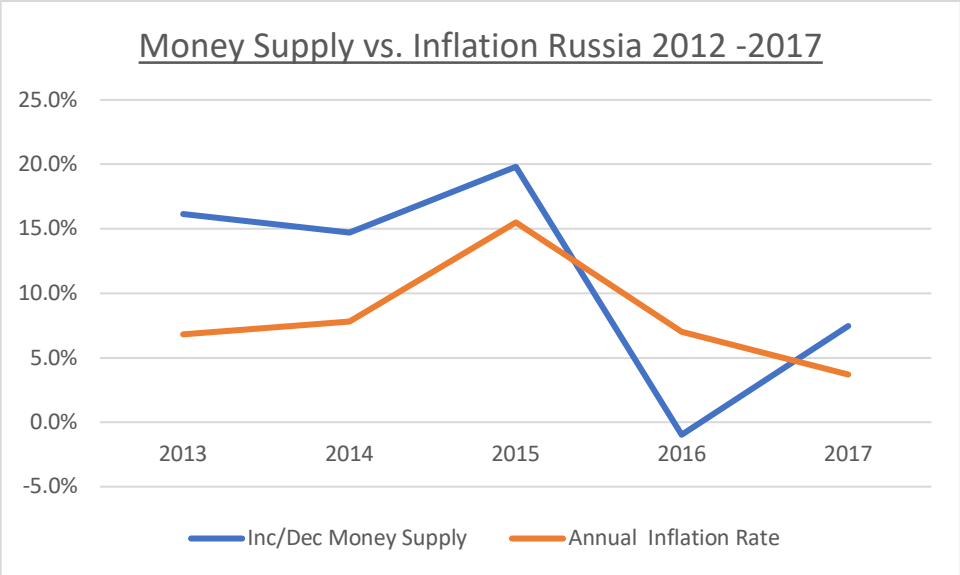
			Nominal Interest Rates			Real Interest Rates		
Period	Year	Inflation Rate	Overnight Interbank Rate	Deposit Rate	Savings Account (Deposit Rate Except Demand)	Difference btw Overnight Rate & Inflation Rate	Difference btw Deposit Rate & Inflation Rate	Difference btw Dep Rate Except Demand & Inflation Rate
1	2013	6.8%	5.50%	6.09%	6.53%	-1.26%	-0.23%	-0.23%
2	2014	7.8%	17.00%	6.04%	8.52%	9.18%	-1.78%	0.70%
3	2015	15.5%	11.00%	9.20%	12.82%	-4.53%	-6.33%	-2.71%
4	2016	7.0%	10.00%	6.97%	10.55%	2.95%	-0.08%	3.50%
5	2017	3.7%	7.75%	5.86%	8.97%	4.07%	2.18%	5.29%

Sources: http://www.cbr.ru/eng/statistics/b_sector/interest_rates_09_e/#highlight=interest%7Crates%7Crate
https://www.focus-economics.com/country-indicator/russia/interest-rate
https://fred.stlouisfed.org/series/IRSTCB01RUA156N
http://data.imf.org/regular.aspx?key=61545855

To find the real interest rate, one must subtract the rate of inflation from the nominal interest rate. This will give the real return one would earn on deposits after the effects of inflation were accounted for.

For example, even though in 2015 the rate paid on consumer savings deposits was as high as 12.82% since inflation was even higher at 15.5%, the real rate of return was negative 2.71% on savings accounts.

4. Money supply for the foreign economy (Russia):



Source: https://data.worldbank.org/indicator/FM.LBL.BMNY.CN?locations=RU
http://www.cbr.ru/eng/statistics/?PrtId=dkfs

Monetarism, which relies in part on the "quantity theory of money," posits that when the money supply increases, so does inflation (Miles, et al., 2012).[5]

Here, there is no clear correlation between the increase or decrease in the broad money supply and inflation. In 2014, the broad money supply decreased while inflation increased. In 2015 both money supply and inflation increased and in 2016 they both decreased. In 2016 their relationship reversed once again.

This can be explained by the relatively short time period examined and lags between changes in the money supply and its effects (Miles, et al., 2012).

[5] Over the long term, the correlation between increases in the money supply and inflation have been as high as .997. In the short term, the correlation does not hold (Miles, et al., 2012).

5.

Ruble Depreciation

The table below shows the fluctuation of the nominal value of the ruble in relation to the USD:

Official Ruble Dollar Exchange Rates
2013-2017

Period	Year	Rubles per Dollar Rounded End of Year	$ per Ruble End of Year	% Inc/Dec $ per Ruble 2013-2017	Increase in Rubles per Dollar
1	2013	33	0.0303		
2	2014	60	0.0167		
3	2015	73	0.0137		
4	2016	61	0.0164		
5	2017	58	0.0172	-43.10%	75.8%

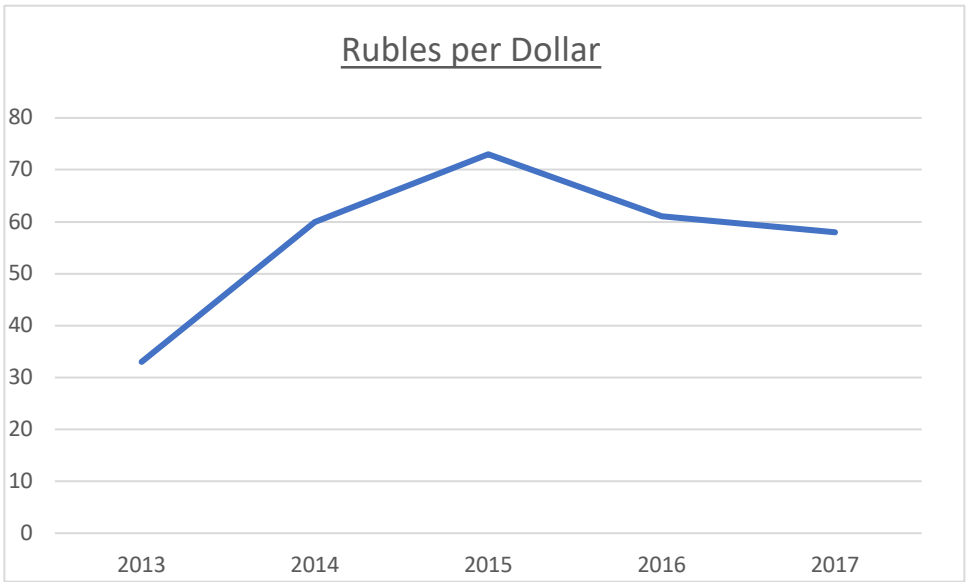
Sources:

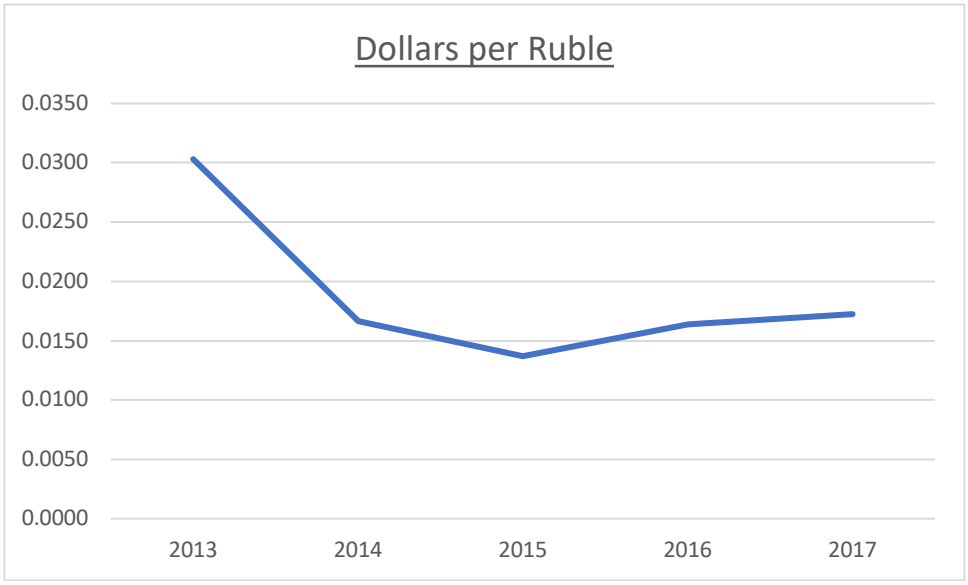
https://tradingeconomics.com/russia/currency
http://data.imf.org/regular.aspx?key=61545850
https://freecurrencyrates.com/en/exchange-rate-history/USD-RUB/2012/cbr

As per the table above, the nominal value of the ruble has depreciated significantly in US Dollar terms during the five year period. It has gone from 33 rubles to the dollar at the end of 2013 to 58 rubles to the dollar at the end of 2018. This means that in nominal terms it depreciated by about 43% or has lost about 43% of its value against the dollar (100 – (33 divided by 58)). At the end of 2017 it took almost 76% more rubles to buy one dollar as it did at the end of 2013 (58 minus 33 divided by 33). Thus, the USD has significantly appreciated (by 76%) against the ruble over the 5 year period.

Even though the ruble did depreciate significantly over the 5 year period it strengthened slightly in 2016 and 2017 as the real economy in Russia began to stabilize and recover after the sharp devaluation that occurred in 2014.

You can see this represented graphically in the charts below:





To find the real depreciation rate based on nominal exchange rates, both the dollar and the ruble amounts just be adjusted for inflation. As seen below, ruble inflation was 38% from 2013 to 2017 and US dollar inflation was 5.2%. Deflating nominal 2017 rubles and dollars back to 2013 constant rubles and dollars and then recalculating the ruble depreciation gives a real depreciation of almost 46%. This means the ruble depreciated almost 7% more in real terms than reflected in nominal terms when taking into account both ruble and dollar inflation (46-43/43).

Table Showing Real (Inflation Adjusted) Ruble Depreciation and Dollar Appreciation:

Official Ruble Dollar Exchange Rates
2013-2017

Period	Year	Rubles per Dollar Rounded End of Year	$ per Ruble End of Year	Nominal Ruble Devaluation (% Decrease $ per Ruble 2013-2017)	Nominal Dollar Appreciation (% Increase in Rubles per Dollar)	Ruble CPI*	Ruble Inflation (Ruble CPI % inc/dec)	Ruble Deflator to 2013 Value	US Dollar Inflation Dollar *CPI	US Dollar Inflation (Dollar CPI % inc/dec)	US Dollar Deflator to 2013 Value	Rubles per USD Period End Constant 2013 Rubles Dollars	Dollars per Ruble Period End Constant 2013 Rubles Dollars	Inflation Adjusted Ruble Devaluation	Inflation Adjusted Dollar Appreciation
1	2013	33	0.0303			121.64			106.8			33	0.0303		
2	2014	60	0.0167												
3	2015	73	0.0137												
4	2016	61	0.0164												
5	2017	58	0.0172	-43.10%	75.8%	168.17	38%	0.7233	112.4	5.2%	0.9502	42	0.0164	-45.93%	27.13%

Sources:
https://tradingeconomics.com/russia/currency
http://data.imf.org/regular.aspx?key=61545850
https://freecurrencyrates.com/en/exchange-rate-history/USD-RUB/2012/cbr
https://data.worldbank.org/indicator/FP.CPI.TOTL?locations=US

*2010=100

However, one could also look at real ruble depreciation or appreciation by using the Real Effective Exchange Rate (REER).[6] REER is an exchange weighted rate that takes into account the value of a currency against a basket of currency from its main trading partners, weighting each rate with its portion of trade (Miles, et al., 2012) (Kenton, 2019) (IMF Communications Department, 2019).

The Formula is as follows:

REER = [Country Exchange Rate]^n X [Country Exchange Rate]^n X [Country Exchange Rate]^n …..

The exchange rate of each country goods and services are traded with is raised to the power of that country's portion of trade. Suppose Russia engages in trade with the US and the EU and

[6] Real Effective Exchange Rate Based on the CPI (International Monetary Fund, 2019).

that 60% of its trade is with the US and 40% with the EU. Its trade weighted effective exchange would be:

EER= [Ruble Dollar Rate]$^{.6}$ X [Ruble Euro Rate]$^{.4}$

The ruble dollar rate is raised to the power of .6 and the ruble euro rate is raised to the power of .4 to provide a "weighted geometric average of bilateral exchange rates" (Miles, et al., 2012).

Using this measure, real depreciation was only 14.5% in the five year period between 2013 and 2017.

Real Effective Exchange Rates
Based on CPI
Russian Federation
2013 -2017

Period	Year	REER	% Change
1	2013	107.0	
2	2014	97.7	
3	2015	79.6	
4	2016	79.2	
5	2017	91.5	-14.5%

Source http://data.imf.org/?sk=4C514D48-B6BA-49ED-8AB9-52B0C1A0179B&sId=1539887168442

Interest Rate Parity

The theory of interest rate parity speculates that interest rates in different countries will be at levels that will compensate for any expected appreciation or devaluation of one currency in terms of the other country's currency caused by fluctuating exchange rates during a given period (Miles, et al., 2012, Chapter 20, pp. 505-518).

If interest rate parity holds, then deposits plus accrued interest in the currency of one country will be equal to deposits plus accrued interest in the currency of the other country at the end of the period. For example, if currency A (in this case the ruble) is expected to depreciate in

relation to currency B (the USD), one would expect to see a higher interest rate paid on currency A in order for it to retain its value (parity) with currency B.

If there is uncovered interest parity, one would expect that deposits plus accrued interest at the end of the period will not be equal when the foreign currency (rubles) is exchanged back into USD at the end of the period.

For them to be equal, the following equation would hold true:

The expected depreciation (or appreciation) of the ruble, $[S^e(1) – S(0)]/S(0)]$, would equal the Ruble Interest Rate – US Interest Rate

Or

$[S^e(1) – S(0)]/S(0)]$ = Ruble Interest Rate – USD Interest Rate

In our case, using the average interest rates for the period, the following should hold true:

58 – 33/33 = 9.48% - .46%

.75 = .0948 - .0046

However,

.75 ≠ .0902

Where:

$S^e(1)$ = Expected Spot Rate of the Ruble in the Future
S(0) = Current Spot Rate of the Ruble

(Miles, et al., 2012)

This means that interest rate parity did not hold during the period. In other words, the interest rate paid on the Russian ruble was not high enough to cover the depreciation in the value of the ruble against the USD.

The table below shows the value of 10,000 USD exchanged into rubles and invested in a Russian ruble savings account at the prevailing ruble dollar exchange rate at the end of 2013 versus the value of 10,000 USD invested into a USD savings account:[7]

[7] For purposes of the exercise, we are using year end ruble rates instead of average ruble rates during the year. Actual results would vary based on ruble dollar exchange rate fluctuations from month to month. We also assume that the interest is compounded monthly during 2013 and every year thereafter and retained in the account for the duration of the period.

Value of 10,000 USD invested in 2013 for five years into ruble savings account

Period	Year	Ruble Short Term Interest Rates per annum	Ruble Short Term Int Rate Expressed as Decimal	**Ruble Monthly int Rate as Decimal (annual rate /12)**	Ruble Dollar Exchange Rate at Year End	Ruble Principal plus Interest from Previous Year *	Total Accrued at Year End (Principal and Interest) Rubles*	USD Short Term Interest Rates per annum	Previous Column Expressed as Decimal	**USD Monthly Int Rate as Decimal (annual rate /12)**	Dollar Principal plus Interest from Previous Year*	Total Accrued at Year End (Principal and Interest) USD*
1	2013	6.53%	0.0653	0.005442	33	330,000 ₽	352,206 ₽	0.17%	0.0017	0.000142	$10,000	$10,017
2	2014	8.52%	0.0852	0.007100	60	352,206 ₽	383,414 ₽	0.12%	0.0012	0.000100	$10,017	$10,029
3	2015	12.82%	0.1282	0.010683	73	383,414 ₽	435,561 ₽	0.23%	0.0023	0.000192	$10,029	$10,052
4	2016	10.55%	0.1055	0.008792	61	435,561 ₽	483,801 ₽	0.64%	0.0064	0.000533	$10,052	$10,117
5	2017	8.97%	0.0897	0.007475	58	483,801 ₽	529,027 ₽	1.15%	0.0115	0.000958	$10,117	$10,234
		9.48% average	0.09478 average				**529,027 ₽**	0.46% average	0.00462 average			**$10,234**
						USD Equivalent at end of period (2017)	**$9,121**					

*Interest compounded monthly using compound interest formula $A=P(1+r)^t$ where t = 12, r=monthly interest rate, A=Accrued Interest and Principal and P= Principal

Sources: OECD (2019), Short-term interest rates (indicator). doi: 10.1787/2cc37d77-en (Accessed on 25 April 2019)

https://data.oecd.org/interest/short-term-interest-rates.htm

OECD (2019), Inflation (CPI) (indicator). doi: 10.1787/eee82e6e-en (Accessed on 25 April 2019)

https://data.oecd.org/price/inflation-cpi.htm

https://www.investopedia.com/articles/personal-finance/062315/how-interest-rates-work-savings-accounts.asp

The average ruble rate during the period was 9.48% while the average USD rate was .46%, a difference of about 9%. This implies that the market was expecting a 9% devaluation of the ruble (Miles, et al., 2012), not 43%.

From this one can infer that expectations for the ruble exchange rate were above those that actually occurred, that is, expectations were that the ruble value would be above what it was – that it would not depreciate to the dollar as much as it did.

For interest rate parity to hold, the ruble would have had to be worth around 51.7 rubles to the dollar (529,027 ₽/$10,234), not 58 (or .0193 dollars to the ruble and not .0115). This would have made the value of both accounts equal at the end of the period, meaning that interest rate parity was maintained.

Since they were not equal, interest rate parity did not hold during this period.

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