

The Purchasing Power Parity and Lebanese Exchange Rates: A Tale from the Crisis Years



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1. Introduction

It is widely established in the economic literature that the Purchasing Power Parity (PPP) holds pretty well during hyper-inflationary times. And, to recap, the PPP hypothesis stipulates that the exchange rate between two countries reflect their price differential (or the difference in their consumer price index). It is assumed that when PPP holds between two countries, a given basket of goods will be of the same price in both countries, after controlling for the exchange rate. In relative or dynamic terms, it also assumes that *changes in the exchange rate should be equal to the differential in inflation rates between the two countries*. If not, then PPP doesn't hold.

That said, Lebanon represents an interesting case where the economy had experienced prolonged hyperinflation¹, during most of the period between October 2019 and August 2023. So a crucial, relevant question is: had the PPP held during that period? And if not, why and what are the implications? These issues are very important, because they reflect whether the Lebanese exchange rate is misaligned or not. If proven that it is, what would be the proper exchange rate regime that would restore and maintain alignment? And, of course, this is a matter that any reform program for Lebanon should seriously consider, as the exchange rate is perhaps the most important price in the Lebanese economy today.

¹ Hyperinflation is defined to be a case when the inflation rate exceeds 20% annually.

2. Theory

The PPP is simply defined as follows:

$$(1) \quad e = P/P^* \quad \text{or} \quad P = e P^*$$

Equation (1) states that the exchange rate between the LBP and the USD is equal to the price ratio between Lebanon and the US, with e being the exchange rate as the price of 1 USD in terms of LBP (implying that a higher e is equivalent to a depreciation in the LBP, and vice versa) and P is the Lebanese price level while P^* is the US price level². This is referred to as the *absolute PPP*. More interesting is the *relative PPP*, which is expressed as follows:

$$(2) \quad \Delta e/e = \Delta P/P - \Delta P^*/P^*$$

Equation (2)³ shows that for the PPP to hold, the change in the exchange rate e should be equal to the differential in inflation rates between Lebanon and the US (note that $\Delta P/P$ and $\Delta P^*/P^*$ are the inflation rates in Lebanon and the US respectively).

Of course, the change in the exchange rate e might not be equal to the inflation rates differential. In this case, we have misalignment. In such a case, too, it becomes important to introduce the real exchange rate re , as:

$$(3) \quad re = eP^*/P$$

As such, from Equation (3), the real exchange rate is simply the nominal exchange rate adjusted for the relative prices between the two countries. For instance, if the price in Lebanon rises relative to that of the US, such that P^*/P falls, and if the nominal exchange rate e rises (depreciates) by an equal magnitude to the fall in P^*/P , then the real exchange rate re will stay constant, and no misalignment occurs⁴. But if the change in e is not equivalent in magnitude to the change in P^*/P , then re will change and misalignment occurs. This is very crucial because it is widely believed that the real exchange rate is the appropriate

²A hypothetical example: if the price of a can of Coke in the US is 0.5 USD and the price of the same can of Coke in country X is 50 Lira, then e or the exchange rate between country X and the US is equal to $50/0.5 = 100$ Lira

³Equation (2) is derived by taking the logarithmic change of Equation (1).

⁴The reasoning is as follows: A rise in P will make domestic goods more expensive and will imply a loss in competitive edge; but to maintain that, e has to rise or depreciate so as to keep the price of domestic goods measured in foreign currency the same; in other words, to keep the real exchange rate re constant.

measure of competitiveness, and any misalignment will have serious effects on the country's competitive edge.

3. Evidence

To test for relative PPP, we will work with equation (2). Accordingly, the model to be estimated will look as follows:

$$(4) \quad \Delta e/e = \beta_0 + \beta_1 (\Delta P/P - \Delta P^*/P^*)$$

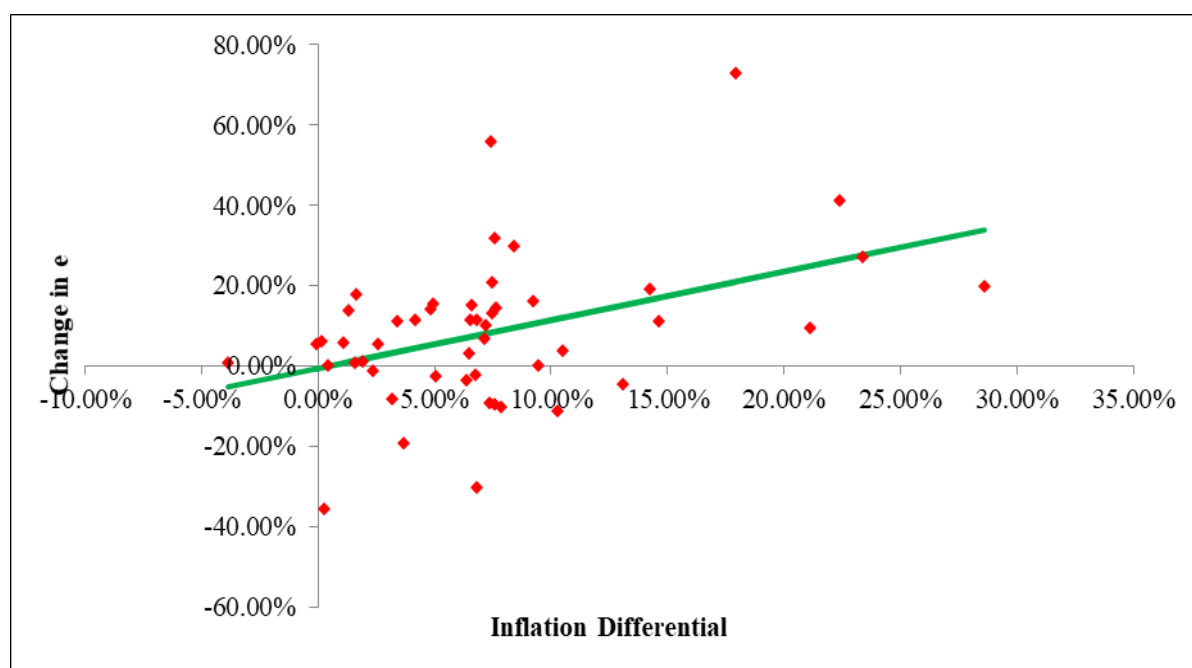
For the relative PPP to hold, the coefficient β_1 should be equal to 1 and, as a result, alignment ensues and the real exchange rate remains stable. Otherwise, the exchange rate will be out of kilter.

The regression results of estimating equation (4) are shown below. The period under study runs from August 2019 to August 2023, that being the period of hyperinflation and over which the nominal exchange rate e kept depreciating before it stabilized in early September 2023 at 89,500 LBP per USD.

Regression Statistics	
Multiple R	0.4222
R Square	0.1783
Adjusted R Square	0.1608
Standard Error	0.1699
Observations	49

ANOVA					
	df	SS	MS	F	Significance F
Regression	1	0.294501639	0.294501639	10.19752467	0.002510379
Residual	47	1.357346753	0.028879718		
Total	48	1.651848392			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept β_0	-0.006120099	0.037046728	-0.165199441	0.86949552	-0.080648502	0.068408305
Inflation Differential β_1	1.20576815	0.377586472	3.193356334	0.002510379	0.446162148	1.965374153



From the above regression results, we can see that the coefficient β_1 is significant (at the 1% level) but is not identical to 1, as it is actually equal to 1.2. This means that a 1% change in the inflation differential between Lebanon and the US generates a 1.2% change in the exchange rate. Before we discuss the implications of this interesting result, a note on the diagnostic tests⁵ performed is analyzed below (for those who are fairly-well technically inclined).

First, to test for first-order autocorrelation, we used the Durbin-Watson test which examines whether the regression residuals are serially correlated, specifically whether the error term in period t is systematically related to the error term in period $t-1$. In more intuitive words, does the effect of inflation last month spill over into this month? The Durbin-Watson statistic was 2.20, which is sufficiently close to the benchmark value of 2, indicating no evidence of first-order autocorrelation in the residuals.

Second, to test for heteroscedasticity, the White test was performed. Considering our sample period only used the time where the exchange rate was varying (not pegged), which also happened to be during the crisis, we do not expect

⁵Since Purchasing Power Parity models are typically estimated using time-series data, where autocorrelation and heteroscedasticity are common concerns, diagnostic tests were conducted to assess whether these assumptions were violated. The volatility of exchange rates and inflation tend to cluster over consequent periods (autocorrelation) and they tend to react to shocks at different scales than during calm periods (change in variance across regimes).

heteroscedasticity to prevail in our model. After running the auxiliary regression, we get an LM statistic of 1.895 which implies a p-value of 38.75% making it insignificant at the 5% level. This implies that there is no sufficient evidence of heteroscedasticity in our model. However, it is important to note that this may vary under a different sample period (a regime switch), and thus we should proceed with caution⁶.

4. Implications

The fact that β_1 is larger than 1 at 1.2 means that, for any given change in the inflation differential between Lebanon and the US, the nominal exchange rate will change by more. This implies that the nominal exchange rate will overshoot upwards, depreciating by more than required to maintain the PPP.

That the exchange rate changed upwards or depreciated by more than warranted by fundamentals is an indication that there were speculative attacks on the currency. Anecdotal evidence has always pointed towards that, by stressing the speculative role played mostly by FX dealers who were politically connected to dominant parties. Now the empirical evidence, as shown here with some rigor, lends support to such inimical behavior⁷.

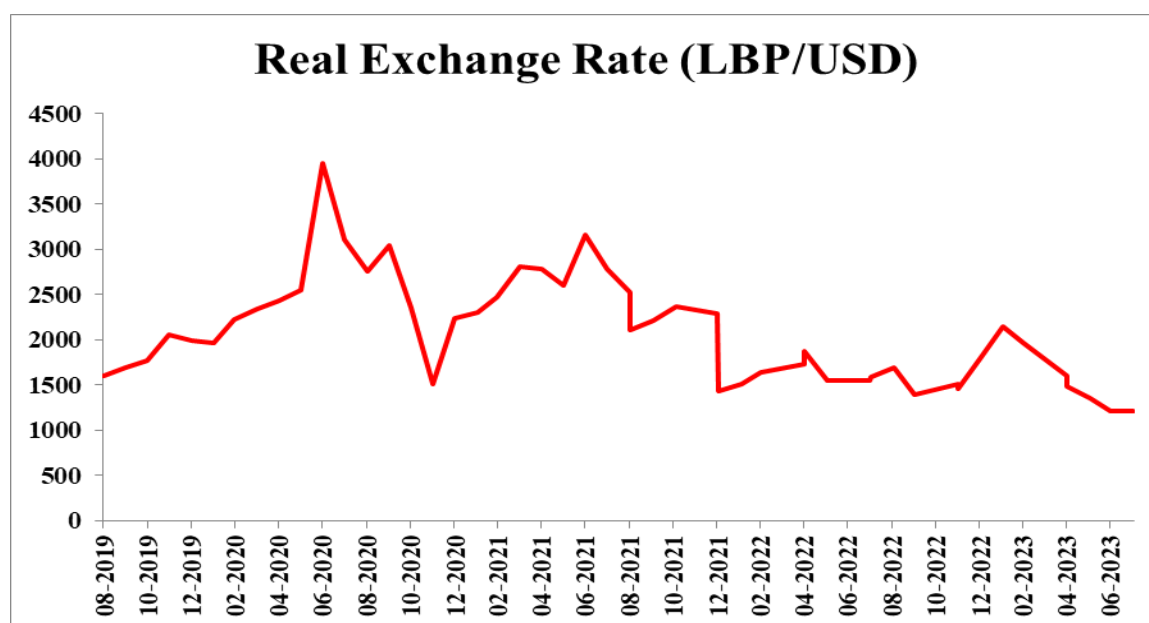
Of course, another implication of the fact that the exchange rate rose by more than the inflation differential is that the real exchange rate had risen or depreciated as well. We have calculated the real exchange rate from the following equations:

$$(5) \quad \text{ret} = \text{ret-1} + \text{ret-1}(\Delta e/e - \Delta P/P + \Delta P^*/P^*) \quad t = 0, 1, 2, \dots, n$$

⁶We have also tested for endogeneity and concluded that it does persist in our model. Considering that the literature supports the relationship between the variables we used, we will proceed with the regression results but with the usual caution.

⁷ We are aware that there are other variables that deny the satisfaction of PPP. The most important ones are tariffs, transportation and operational costs, and non-tradeables. But all these variables actually increase the change in inflation differentials by more than the exchange rate and produce a lower real exchange rate or an appreciated one – the opposite of what we obtained for Lebanon.

⁸ The derivation is based on the logarithmic change of Equation (3).



The figure above shows the calculated values for re generated from Equation (5) during the studied period (note that with August 2019 being the base month, or time t_0 , the nominal exchange rate e and the real exchange rate re start as one and the same at about 1,500 LBP on that date). The average re for that period was close to 2,100 LBP, thus higher than the base year of 1,500 LBP and indicating a depreciation in the Lebanese real exchange rate during that hyperinflation period. Just as important, a depreciation in the real exchange rate should make Lebanese exports more competitive, and that was what we actually obtained as goods exports increased from \$2.95 billion in 2018 to an average of \$3.53 billion during the 2019-2023 period, and that was a period mind you of excessive political, economic, and health turmoil⁹.

⁹Lebanese goods exports reached: \$3.73 billion in 2019; \$3.54 billion in 2020; \$3.88 billion in 2021; \$3.49 billion in 2022; and \$2.99 billion in 2023.

5. Conclusion

We would like to close with a forward-looking note. We have shown that PPP wasn't satisfied during most of the crisis years in Lebanon, and the real exchange rate was notably higher or depreciating. The implication is that the nominal exchange rate was undervalued. In fact, this is still supported by the informal Big Mac Index (until a more rigorous evidence is established): with a Big Mac in the US at an average of 6 USD and in Lebanon at 480,000 LBP, the PPP exchange rate should be 80,000; however, the exchange rate is currently at 89,500 LBP; so the current exchange rate is undervalued by about 10,000 LBP. But that is a good thing, because as the economy recovers going forward, the exchange rate is bound to improve, and a crawling or adjustable peg regime – assuming it proves to be the desired regime – will gradually appreciate the nominal exchange rate until all the undervaluation is eliminated and a new equilibrium exchange rate is finally reached. That is, if and when the war and all the mindless mess we are in now are behind us!

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