



One-Sided Linking of Mortgage Loans to the Price of Foreign Currencies

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Abstract

Complex securities that are based on combinations of bonds and derivatives have become very common. The translation to such inventions to loans to private household borrowers changes the rules of the game of derivatives and this practice becomes potentially unfair. The paper demonstrates this contention by reference to one particular fairly popular arrangement of home mortgage loans where the monthly payments are one-sided linked to a currency exchange rate. A real world example is described, a pricing model applied. The complexity of the valuation process is beyond comprehension even to intelligent rational borrower. Hence these types of loans are potentially unfair to naïve borrowers.

Keywords: Currency linked loans, One-sided linkage, Put options, Valuation model,

1. Introduction

In several countries, and in particular in countries with a ‘weak currency’, it is customary for banks and other lending institutions to offer their customers who wish to borrow funds, especially mortgage loans, an arrangement by which the payments or the servicing of the loan is linked to the price of a particular foreign currency. The loan is offered in terms of the local currency. The initial loan amount is translated into the designated foreign currency at the spot exchange rate and the monthly mortgage payment is computed in accordance with the interest rate that is contractually agreed upon with the borrower. The payments are in the form of ‘blended payments’ where each monthly amount contains both interest and principal, and determined in term of the foreign currency. Then, the actual monthly payment is paid in the local currency where the amount payable in each month is determined by the local currency price of one unit of the foreign currency, or by the spot exchange rate that is in effect every time a payment is due.

This arrangement is rather customary in many countries, especially in small countries where lending institutions finance their operations by issuing foreign currency denominated securities. Thus, from the vantage point of the lending institution this type of foreign currency linked loans plays a role of a natural hedge against unexpected changes in the exchange rate.

In some cases, a special type of foreign currency linked loans has emerged. This type that became common practice by several lending institutions is a one-sided linkage to the exchange rate.

In many instances the borrower is not offered a choice between a two-sided regular foreign currency linked loan and a one-sided foreign currency linked loan.

We argue that such a loan is in most cases an unfair contract. If lenders (mortgage banks) may be able to assess the economic value of such loans, most borrowers (households) do not have the tools, the skills and the knowledge to assess the true cost of these loans. They fail to realize the loan agreement is unfair.

2. One-Sided Currency Linked Loans

We describe such loans as contracts that are a combination of a regular foreign currency linked loan combined with a series of European put options on the foreign currency that the lender (the mortgage bank) receives from the borrower. We show the complexities of evaluating the value of these foreign currency options and derive some conclusions regarding the fair treatment of borrowers who agree to borrow under such conditions. We use the original (Biger and Hull, 1982) foreign currency option pricing model¹ and indicate the implications of such loans.

In a second part of the paper we consider the contractual status of bond holders where the bonds were written with one-sided linkage to the exchange rate in process of liquidation of the borrowing firm. The legal aspects of such arrangements are reviewed with reference to the value of the options embedded in these bond or loan contracts.

¹ Biger and Hull (1982).

3. Description

The mortgage market and especially the home loan mortgage market have seen tremendous changes in recent years. In Israel, due to the daily changes in the exchange rate between the Israeli Shekel and the US dollar, most mortgage lenders offered their customers loans that were fully linked to the dollar exchange rate². The amount of the loan would be translated into US dollars at the spot exchange rate at the time the loan contract is signed. The dollar interest rate is agreed upon (fixed or variable as the case might be), and the monthly dollar payment is computed. Then each month the payment in local currency is determined by reference to the spot US dollar exchange rate. This type of a mortgage loan was very common in Israel until about four years when the US dollar started to weaken against the New Israeli Shekel (NIS).

Mortgage lenders then introduced a twist in the manner of foreign currency linked loans. They instituted a contract whereby the monthly payments were bounded from below, or had a floor. These contracts are the one-sided linked loans to the foreign exchange. In this type of an arrangement the initial spot exchange rate, or the basis rate, S_B , is recorded in the loan agreement. The monthly payments in terms of the local currency are then determined in the following manner:

$$\text{Monthly payment} = \begin{cases} \text{Foreign currency amount} \times S_T \text{ (the spot exchange rate) if } S_T \geq S_B \\ \text{Foreign currency amount} \times S_B \text{ (the basic rate) otherwise,} \end{cases}$$

where S_T is the spot exchange rate at date T of each monthly payment.

If one were to consider a one year zero-coupon loan that was provided under these terms, then the loan could be described as a combination of two components:

- a. A regular one year loan where the payment of the principal is fully linked to the exchange rate or the local currency price of one unit of the foreign currency. The lender thus receives from the borrower an IOU that is fully linked to the local price of the foreign currency.
- b. A European put option – an option to sell the principal amount of the foreign currency loan at a price S_B to the borrower.

Thus, if the spot exchange rate upon maturity, S_T , is higher than S_B , the lender doesn't exercise the option. The lender receives S_T times the foreign currency value of the principal. If $S_T < S_B$, then the lender does exercise the put option, selling the foreign currency value of the principal at a price S_B to the borrower. Under these conditions the borrower pays the amount, in terms of the local currency, in accordance with the contract.

The arrangement becomes more complicated when the one-sided foreign currency linked loan is in a form of a mortgage loan. Consider such a loan that is to be paid back by monthly installments over a period of twenty years. The manner in which a 'regular' foreign currency linked loan would be tailored is as follows: the initial loan is first translated into the terms of the foreign currency. Assume that the loan is given at a fixed monthly rate of interest for the entire period. Then given the agreed upon monthly rate of interest the monthly foreign currency payment over the entire period is computed. Each month, the local currency payment is determined by multiplying the (fixed) foreign currency monthly amount by the spot exchange rate on the day of payment.

In case where the mortgage loan is given under condition of a one-sided linkage to the price of foreign currency, then the lender is effectively receiving from the borrower a set of 240 European put options. The first one expires in one month, the second in two months and so on, while the last one expires in 240 months. Each of these options provides the lender with the option to sell to the borrower the fixed amount of the foreign currency payment at the exchange rate S_B .

4. An Example

The following is a description of an actual case that took place in Israel. A person received a mortgage loan of NIS 1 million from a mortgage bank to purchase an apartment in Haifa, Israel. It was a 15 year loan, fully linked to the US dollar, both principal and monthly interest.

At the time, the rate of interest on the loan was 4% annually, or 0.327374% per month.

A one million NIS mortgage loan at an annual interest rate of 4% given for 15 years (180 months) with blended monthly payments – interest and principal, implies a monthly payment of NIS7,361.09.

The mortgage loan was contractually linked to the exchange rate of the US dollar. At the time the contract loan was signed, the exchange rate was NIS4.50 per dollar. This was the *BASIC RATE*, S_B , and this exchange rate was explicitly inserted in the loan contract.

Thus, a 'standard' mortgage loan that is fully linked to the NIS exchange rate of the dollar would be treated as follows:

At the exchange rate on contract date was NIS4.50 per US dollar, the monthly payment are equivalent to \$1635.80.

It follows that if, in a given month, the exchange rate is, say, NIS4.60 per dollar, then the NIS payment should be NIS7,524.67, not NIS7,361.09.

The loan contract explicitly stated the *BASIC RATE* of NIS4.50 per dollar. The monthly payments each month would therefore be NIS7,361.09, times the exchange rate on the day of payment, S_t , divided by the BASIC RATE.

[1]...Monthly payment = NIS7,361.09 x (S_t / S_B)

Before signing the mortgage loan agreement, the bank inserted another paragraph to the agreement: The bank insisted that the linkage to the exchange rate will be one-sided.

² Definition: A bond in which the coupon and/or redemption value are linked to the movement in an exchange rate. Source: IMF (2003).

More specifically, the paragraph stated that if the exchange rate in any given month is higher than the *BASIC RATE*, then the monthly payment will be determined in accordance with the formula [1] above.

Otherwise, the payment will be the original NIS amount of NIS7,361.09
Simply stated, if the NIS price of the dollar rises above 4.50, the borrower pays more.
If the price of NIS price of the dollar falls below 4.50, *the borrower doesn't pay less*.
Payment in month t $= (7,361.09 \times S_t/S_B \text{ if } S_t > S_B$
 $= (7,361.09 \text{ otherwise}$

The lender (the bank) therefore is protected against a rise in the NIS price of the dollar, and doesn't suffer if the NIS price of the dollar falls below 4.50.

Such a loan agreement contains a one-sided linkage of the monthly payment to the exchange rate.

Consider the essence of such a loan and the economic difference between a 'regular' foreign currency denominated loan and a one-sided foreign exchange linked loan.

Furthermore – consider the potential harm to the borrower who agrees to accept such a loan and how should the borrower be compensated?

5. The Economic Meanings of Such one Sided Linked Loans

A one-sided linked loan, or a loan with a floor, is a loan (or a deposit) where the currency linkage comes to a halt in cases where on payment due dates the actual exchange rate is lower than the basic exchange rate. In such cases the actual due payment is based on the basic exchange rate that is stated in the loan contract.

It is thus necessary to clarify the economic meaning of one-sided linkage, the complexity of the arrangement and in particular the difficulties of evaluating the fair value of such loan to the lender and to the borrower.

We start with a one year loan of NIS 4,500, linked to the exchange rate of the US dollar. The spot exchange rate is NIS4.50 (this is the *BASIS EXCHANGE RATE*), and therefore the loan is equivalent to \$1,000.

In one year the borrower must return the loan plus 4% interest. The payment will be the NIS equivalent of \$1,040, where the NIS amount will be determined according the exchange rate in one year.

Also assume that the lender (the bank) insists that the loan will be one-sided dollar linked loan, with a *BASIS EXCHANGE RATE* of NIS4.50 per dollar.

The borrower will then pay the bank at least NIS4,680 (\$1,040x4.50), but if the exchange rate in one year is higher than 4.50 the borrower pays more.

The loan can be describes as a regular dollar-linked loan, but in addition the lender (the bank) receives from the borrower an option to sell to the borrower, on due date, \$1,040 at a price of NIS4.50.

On due date, the borrower pays the lender the NIS equivalent of \$1,040 *according to the then spot exchange rate*.

With regard to the option given by the borrower to the lender, if on due date the exchange rate is higher than NIS4.50, the lender doesn't exercise the option, and receives \$1,040 times the new spot exchange rate. For example, if he exchange rate is NIS4.70, the lender gets NIS4,888

Conversely, if the spot exchange rate is lower than the *BASE RATE* of NIS4.50, for example if the exchange rate is 4.20, then if the loan were a regular dollar linked loan the lender would receive $1,040 \times 4.20 = \text{NIS}4,368$. But now the lender also exercises the option, gives the borrower \$1,040 and will receive NIS4.50 per dollar or NIS4,680.

The bank however purchases the \$1,040 at NIS4.20 per dollar, i.e. for NIS4,368.

As a result of purchasing the 1,040 dollars at 4.20 and exercising the option by selling the dollars at 4.50, the bank gains NIS312.

When the NIS312 gain is added to the direct proceeds from the payment according to the spot rate (NIS4,368), the banks' total proceeds amount to NIS4,680. This is what the borrower actually pays.

6. Valuation – An Example

The option that is embedded in the one-sided linked loan is a European put option. Prior to expiration the option does have some economic value. The value depends upon several factors, one of which is the uncertainty about the exchange rate that will actually prevail on the day of payment.

Other factors are the spot exchange rate, the exercise price, the time to expiration of the option, the risk - free rates of interest on both currencies and the time to expiration.³

In a fair deal if the borrower is requires to grant the lender the option, one may assume that the borrower should be entitles to get something in return.

The compensation could for instance be a proper reduction in the interest rate on the loan compared to the rate the borrower would be required to pay on a regular dollar linked loan. Alternatively, the value of the option should be subtracted from the initial loan amount and then the agreed upon interest rate will be used in order to determine the monthly dollar payments.

The next chart demonstrates the model to estimate the value of the put option. In the example the present exchange rate and the one year forward rate are both NIS4.50 per dollar. The annual interest rates on both currencies are 4% (or 0.327374% per month).

It is also assumed that the annual volatility of the exchange rate is 8%, reflecting the uncertainty or the 'ignorance' of the market regarding the true exchange rate one year from now around the expected one year rate.

³ The first European currency option model was developed by John Hull and Nahum Biger referred to above and published in 1982.

<u>Biger-Hull European Currency Options</u>			
$c = e^{-rT} [Fx N(d_1) - EX \times N(d_2)]$			
By put-call parity: $p = c - e^{-rt} [EX - F]$			
where $d_1 = [\ln(F/EX) + 0.5\sigma^2 T] / \sigma T^{0.5}$			
and $d_2 = d_1 - \sigma T^{0.5}$			
<u>Application of the model for valuation:</u>			
<u>Data:</u>			
Monthly r	0.327374%		
T in months	12		
T in years	1		
Annual σ	8.00%		
e^{-rT}	0.9967		
F (NIS/\$)	₪ 4.50		
EX (NIS/\$)	₪ 4.50		
<u>Computations and results:</u>			
Ln (F/EX)	0.000		
d_1	0.0809		
d_2	0.0009		
N(d_1)	0.5322		
N(d_2)	0.5004		
Call options value	₪ 0.1430		
Put option value	₪ 0.1430		

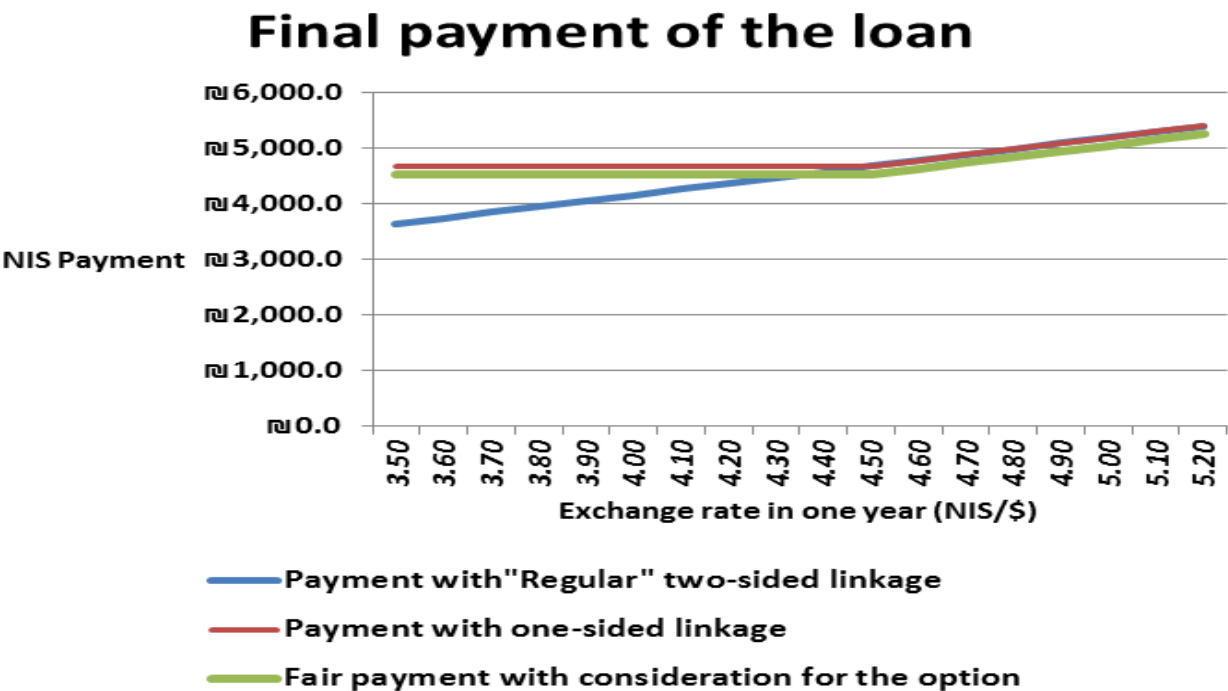
F (NIS/\$)	Put Value	P as a % of F
4.45	0.1687	3.79%
4.40	0.1970	4.48%
4.35	0.2280	5.24%
4.30	0.2617	6.09%

The simplistic example just described demonstrates the essence of the one-sided linkage. A one sided foreign currency denominated loan is in actuality a ‘regular’ foreign currency denominated loan and in addition the lender (the bank) receives from the borrower (the household) a put option. The option has a certain value that provides the lender with an opportunity to enjoy both worlds: To receive higher amount when the exchange rate becomes higher than the *BASIC RATE*, and not to ‘suffer’ when the exchange rate is lower than the *BASIC RATE*.

The example demonstrates the complexity of such a loan.

But this example was a simple one dealing with a loan for one year where at the end of the year the borrower must pay back the principal plus interest.

The one year loan with 'regular' and one sided linkage to the exchange rate			
Exchange rate in one year (NIS/\$)	Payment with "Regular" two-sided linkage	Payment with one-sided linkage	Fair payment with consideration for the option
3.50		₪ 4,680.0, 0.640.0	₪ 4,531.3
3.60	₪ 3,744.0	₪ 4,680.0	₪ 4,531.3
3.70	₪ 3,848.0	₪ 4,680.0	₪ 4,531.3
3.80	₪ 3,952.0	₪ 4,680.0	₪ 4,531.3
3.90	₪ 4,056.0	₪ 4,680.0	₪ 4,531.3
4.00	₪ 4,160.0	₪ 4,680.0	₪ 4,531.3
4.10	₪ 4,264.0	₪ 4,680.0	₪ 4,531.3
4.20	₪ 4,368.0	₪ 4,680.0	₪ 4,531.3
4.30	₪ 4,472.0	₪ 4,680.0	₪ 4,531.3
4.30	₪ 45,76.0	₪ 4,680.0	₪ 4,531.3
4.40	₪ 46,80.0	₪ 4,680.0	₪ 4,531.3
4.50	₪ 47,84.0	₪ 4,680.0	₪ 4,531.3
4.60	₪ 4,888.0	₪ 4,784.0	₪ 4,635.3
4.70	₪ 4,992.0	₪ 4,888.0	₪ 4,739.3
4.80	₪ 5,096.0	₪ 4,992.0	₪ 4,843.3
4.90	₪ 5,200.0	₪ 5,096.0	₪ 4,947.3
5.00	₪ 5,304.0	₪ 5,200.0	₪ 5,051.3
5.10	₪ 5,408.0	₪ 5,304.0	₪ 5,155.3
5.20	₪ 5,408.0	₪ 5,408.0	₪ 5,259.3



In order to clarify the complexity of one sided foreign exchange denominated loans consider the actual real-world case that was described above.

A 15 year NIS 1.0 million mortgage loan with monthly blended payments, at 0.327374% interest per month, (4% annual rate), linked to the exchange rate of the dollar at the end of each month.

If the loan were to be a regular dollar denominated loan than the monthly payments would be computed by translating the NIS1.0 million into US dollars, i.e., \$222,222 at the spot exchange rate of 4.50, then compute the monthly dollar payment, \$1,635.80.

The payment of each of the 180 monthly payments would then be determined by multiplying the monthly dollar amount by the spot exchange rate in each month.

But since the loan is one sided linked to the exchange rate, the borrower actually received a ‘regular’ foreign currency denominated loan, but at the same time the borrower granted the lender (the mortgage bank) *a bundle of 180 European put options*, each of which enables the lender to sell \$1,635.80 at an exchange rate of NIS4.50 per 1 dollar, or for NIS7,361.10.

Each of these options has a different expiration date. The first expires in one month, the second – in two months and so on while the ‘last’ put option expires 180 months (15 years) from the initial date of the loan contract. It is well known that the longer the expiration period, the higher the value of the put option.

The economic value of the package of these European put options is complex. It is the sum of the values of each of these put options.

In to following table we use the Biger-Hull European currency options model to estimate the value of each of the 180 put options under the following assumptions:

- The spot exchange rate is equal to the forward exchange rate for each of the next 180 months (equivalent to the assumption that the term structure of interest rates on both NIS and the dollar are identical).
- The exchange rate (spot and forward) is NIS4.50 per US dollar.
- The interest rate (“risk free”) in both countries is 4% per year.
- The annual volatility of the exchange rate is 8%.

None of these assumptions is more than an assumption, especially the assumption regarding the volatility. The estimates below refer to the option to sell one dollar.

Estimation of the values of the European Put Options

Tin Months	P	Tin Months	P	Tin Months	P	Tin Months	P	Tin Months	P
1	0.041447	37	0.24945	73	0.346683	109	0.419154	145	0.478337
2	0.058598	38	0.252724	74	0.348947	110	0.420948	146	0.479842
3	0.071746	39	0.255952	75	0.351193	111	0.422733	147	0.481341
4	0.082821	40	0.259136	76	0.353422	112	0.424507	148	0.482833
5	0.092569	41	0.262278	77	0.355635	113	0.426273	149	0.484318
6	0.101375	42	0.265379	78	0.357831	114	0.428028	150	0.485797
7	0.109465	43	0.268441	79	0.360012	115	0.429775	151	0.48727
8	0.116988	44	0.271464	80	0.362176	116	0.431512	152	0.488737
9	0.124048	45	0.274451	81	0.364325	117	0.43324	153	0.490197
10	0.13072	46	0.277401	82	0.366459	118	0.43496	154	0.491652
11	0.13706	47	0.280318	83	0.368578	119	0.43667	155	0.4931
12	0.143112	48	0.283201	84	0.370683	120	0.438372	156	0.494542
13	0.148912	49	0.286051	85	0.372773	121	0.440065	157	0.495979
14	0.154487	50	0.28887	86	0.374848	122	0.441749	158	0.497409
15	0.159862	51	0.291658	87	0.37691	123	0.443425	159	0.498833
16	0.165056	52	0.294417	88	0.378958	124	0.445092	160	0.500252
									Continue

17	0.170086	53	0.297147	89	0.380993	125	0.446752	161	0.501665
18	0.174966	54	0.299849	90	0.383015	126	0.448403	162	0.503072
19	0.179707	55	0.302523	91	0.385023	127	0.450046	163	0.504474
20	0.184321	56	0.305171	92	0.387019	128	0.451631	164	0.50587
21	0.188817	57	0.307793	93	0.389002	129	0.453309	165	0.50726
22	0.193204	58	0.310389	94	0.390972	130	0.454928	166	0.508645
23	0.197488	59	0.312961	95	0.39293	131	0.45654	167	0.510024
24	0.201676	60	0.315509	96	0.394876	132	0.458144	168	0.511398
25	0.205774	61	0.318034	97	0.396811	133	0.45974	169	0.512766
26	0.209787	62	0.320536	98	0.398733	134	0.461329	170	0.51413
27	0.21372	63	0.323015	99	0.400644	135	0.462911	171	0.515488
28	0.217578	64	0.325472	100	0.402544	136	0.464485	172	0.51684
29	0.221364	65	0.327909	101	0.404432	137	0.466052	173	0.518188
30	0.225081	66	0.330324	102	0.40631	138	0.467612	174	0.51953
31	0.228735	67	0.332719	103	0.408176	139	0.469165	175	0.520867
32	0.232326	68	0.335094	104	0.410032	140	0.470711	176	0.522199
33	0.235859	69	0.337449	105	0.411877	141	0.47225	177	0.523526
34	0.239335	70	0.339785	106	0.413712	142	0.473782	178	0.524848
35	0.242758	71	0.342103	107	0.415536	143	0.475307	179	0.526165
36	0.246128	72	0.344402	108	0.41735	144	0.476825	180	0.527477

The recipient of the loan, the borrower, gave the lender (the bank) a bundle of 180 European put options, each of which if for the sale of 1 dollar at a price of NIS4.50.

The total value of the 180 put options that the borrower grants the lender is NIS 64.92.

The present value of the 180 payments of \$1.00 payments at an annual rate of interest of 4% is \$135.85.

Translated into dollars at the spot exchange rate that is also the *BASIC RATE*, the dollar value of the 180 put options is \$14.426.

The value of these options is then 10.62% of the value of the loan.

When the loan contract was arranged, the monthly dollar equivalent of the payments was computed based on the agreed upon 4% rate of interest, but these computations were made without due regard to the value of the 180 put options granted by the borrower to the lender.

The determination of the monthly dollar equivalent payments under the condition of one-sided linkage to the exchange rate should have been done with explicit consideration of the value of the options that the lender (the bank) insists on getting from the borrower.

In our example, the value of the options is about 10.62% of the present value of the loan.

Therefore, in a fair deal the determination of the monthly dollar equivalent payment should have been based on the total value of the loan less the value of the options.

In our case, the monthly dollar equivalent payments should have been based not on a total loan of \$222,222, but on a total loan of only \$198,622, and the monthly dollar equivalent payments should have been \$1,445.72 and not \$1,635.80.

The monthly payments should have been only 89.38% of what the borrower was actually charged. On a loan of NIS 1.0 million the minimum monthly payments were determined to be NIS 7,361.09. According to the estimates presented above, taking into consideration the value of the 180 options granted by the borrower to the lender, the minimum monthly payment should have only been NIS 5,579.34. The present value of the 180 options in our example was \$23,600, or NIS 106,200. This is the damage that the naïve borrower suffers.

It should be noted that what was presented here was only an example, based on a set of assumptions regarding the "input" of the option pricing model. Different insertions would render different values of the bundle of the options. In periods of higher uncertainty regarding the exchange rates of the future, the volatility estimates will probably be higher and the value of the entire package of the put options will be higher as well. It follows that an arrangement of a home mortgage loan that is one-sided linked to the exchange rate is likely to be even less fair to the borrower.

7. Normative background and behavioral characteristics

The analysis presented above clearly demonstrates that one-sided currency linked loans are at least problematic from the vantage point of the borrower. It is clear that in some circumstances where the borrower can't evaluate the economic meaning of the loan contract, the contract harms his interests. However such contracts are common and therefore one should examine the normative background and the behavioral characteristics of such contracts. Several legal issues may also be connected to such loan arrangements.

In the UK the central law dealing with loans is the Consumer Credit Act that deals with consumers arrangements related to credits with no specific definition of a loan. In the United States the law dealing with loans is the Truth in Lending Act⁴ that deals with the duty to reveal all details regarding the true cost of debt. Western European countries, mainly in Germany, France, Italy and also in the Russian Federation with the Civil Codex, adopted another approach and enacted laws that regulate legally the essence of the loan contract and the specific arrangements of each contract.⁶

⁴ Consumer Credit Act, 1974. c. 39. § 9 – 10 (Eng)

The behavioral aspects From the economic analysis it is clear that a one-sided currency linked loan contract from the vantage point of the borrower is not purely economically rational. It fails to attain an economic equilibrium in that it is generally biased in favor of the lender.

Explanations to the irrational willingness of borrowers to accept such loans might be found in areas of consumer behavior that are not purely economic but that are related to the principles of behavioral science. This analysis touches upon the two disciplines, economics and law.

The leading explanation of the borrowers' acceptance of such contracts is that even when borrowers are cognizant of some binding terms in the loan contract, such as one-sided linkage, they can't weigh the costs versus the benefits and arrive at rational decisions. In some cases borrowers will tend to totally ignore these caveats because they don't have the knowledge or the tools to evaluate the costs in order to request proper compensation for granting the put options that are embedded in the loan contract to the lender.

Kahneman and Tversky who studied the psychologic biases⁵ found that tendency to ignore low probability events (in our case the decline of the exchange rate), over optimism and self-assurance create the phenomenon that borrowers tend to ignore specific items in the loan contract. Such behavior is typical when the contract special terms are not part of the regular life of the loan contract, and borrowers will tend to ignore these terms if the past experience was that such events (falling price of the foreign currency) don't really occur.

Another explanation to the seemingly irrational behavior of borrowers is proposed by Becher⁶ who suggests that people have string preference to the present over the future and therefore they tend to under estimate future risk and loss of benefits.

8. Conclusions

The use of complex securities by financial institutions is wide spread. Financial engineering is common in many transactions between major borrowers and lenders. In many instances it is difficult to actually assess the value of such complex securities but lenders and borrowers agree on terms and conditions embedded in such complex securities. It is conceivable that the acceptance of such complex securities by major lenders and borrowers reflects the fact that these actors operate on the basis of well diversified portfolios and therefore the inability to properly assess the value of each of these complex securities faded away or being diversified.

At variance, when the use of complex securities such a one-sided currency linked loans are offered to individual households or to family borrowers, the implications are different. First, the borrower fails to recognize that by accepting such a loan, she unknowingly gives the lender a valuable bundle of options. In particular, the borrower has no clue as to the value of the bundle of options that the lender demands and thus fails to request a proper compensation for the options. Second, the borrower has no way to hedge the risk or to undo the gift that she gives to the lender, or to unbundle the package in any way. No currency options for up to 15 years expiration time exists. Third, the demonstration that was presented in the paper is only an example. Even the lending institution that may employ a well-equipped financial economics department with top analysts can't determine the true value of the put option package because future risk-free short term interest rates are at best a reflection of what the market now believes these rates will be in the future, but such beliefs or perceptions may change tomorrow. Furthermore, nobody truly knows or has any reliable clue as to the volatility of exchange rates in the future. After all, these 'volatilities' are nothing but a reflection of our ignorance regarding the extent to which exchange rates in the future will be different from the expected.

It follows that such one-sided currency linked mortgage loans, or household loans, being potentially unfair, should not be offered. This will be very much in line with the Biblical rule of conduct: The Bible states (Leviticus 19:14): *"You shall not curse the deaf nor place a stumbling block before the blind; you shall fear your God - I am your Lord."*

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⁵ Daniel and Amos (1974), Daniel and Amos (1979).

⁶Shamuel (2007).