ב"ה

Interest Free Wage Linkage
of Personal Loans and Mortgages

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Opening remarks

I arrived in Israel in December 1978 - כסלו תשל״ט, during a period of high inflation that continued for a number of years. There was economic turmoil.

During those years prices increased by 25% every month or two, and penalty interest rates reached about 1760% per annum. I clearly remember seeing a sign on a shop selling car accessories warning - "deferred payments bear interest of 4% a day".

During those years, three zeroes were removed from the currency - remember the lira and the shekel before the new shekel. Sadly, there was a state of economic collapse. Tragically, someone committed suicide because of escalating debts.

It is a pity that all this happened amongst a people required by the תורה not to exact interest from each other.

In spite of all this, there were glimmerings of hope during those years of high inflation. The גמ"ח for example, continued to give interest free loans. Also, I remember a radio program where people phoned in to make contributions, instead of money, some gave "a day", "a week" whilst a friend even contributed "a month". Contributing time, had become more meaningful than contributing money, which was collapsing. These events somehow gave me the idea of interest free linkage to the average wage. Since then, I have worked on this idea, from time to time over the years.

"Time is money" so the saying goes. Money can be lent and borrowed but is this true for time? If time is money, does it have a representative exchange rate (שער יציג)? If time is money, can it be used for defining prices, apartment rentals, fees, balances, monthly payments, municipal rates and so on? By using the average wage for debt linkage, we can get quite close to lending and borrowing time. Yes, time is money and the average wage is its representative exchange rate. Yes, prices, apartment rentals, fees, balances, monthly payments, municipal rates and so on can be defined in terms of time.

Lending with interest has generated hatred and persecution of the Jewish people and we must not forget the lesson of history. Here I have tried to propose an alternative, which is fair to borrower and lender, and takes into account moral and economic considerations. My prayer and my plea, is that we remember the lesson of history, and make the appropriate changes.

Index formulae by example

Initial purchase -
Fruit basket: 3 kilos apples and 5 kilos bananas.
Prices: apples at 3 coins a kilo and bananas at 2 coins a kilo.

Most recent purchase -
Fruit basket: 4 kilos apples 1 kilo bananas.
Prices: apples at 2 coins a kilo and bananas at 4 coins a kilo.

Laspeyres' Index

The change in price of the initial fruit basket is calculated as a percentage ratio.

$(3×2+5×4) / (3×3+5×2) ×100 = 26/19×100=136.8$

Paasche's Index

The change in price of the most recent fruit basket is calculated as a percentage ratio.

$(4×2+1×4) / (4×3+1×2) ×100 = 12/14×100=85.7$

Fisher's Index

Fisher's index is the geometric mean (square root of the product) of Laspeyres' and Paasche's indices

$\sqrt{(136.8 \times 85.7)} = \sqrt{11723.76} = 108.3$

Unit Index

The change in the cost per kilo of fruit at each purchase is calculated as a percentage ratio.

Cost per kilo at initial purchase
(3×3+5×2)/(3+5)=19/8=2.375

Cost per kilo at most recent purchase
(4×2+1×4)/(4+1)=12/5=2.400

The change expressed as a percentage ratio is
2.400/2.375×100=101.1

Normalized Unit Index

"Normalized unit" of an item, is the amount of that item that can be purchased for one unit of currency based on its mean price per item for the purchases compared.

The mean price per item over the two purchases is the total amount paid for the items purchased divided by the total amount of items purchased.

For apples this is (3×3+4×2)/(3+4)=17/7 coins per kilo.
For bananas is (5×2+1×4)/(5+1)=14/6 coins per kilo.

Normalized unit for apples is 7/17 kilo
Normalized unit for bananas is 6/14 kilo

The costs per normalized units are:-

At the initial purchase we have:-
Total cost for 3 kilos apples and 5 kilos bananas is 19 coins (as before).
Total normalized units bought is
$3/(7/17)+5/(6/14)=3×(17/7)+5×(14/6)=18.952$.
Cost per normalized unit $19/18.952=1.003$

At the most recent purchase we have:-
Total cost for 4 kilos apples and 1 kilo bananas is 12 coins (as before).
Total normalized units bought is
$4/(7/17)+1/(6/14)=4×(17/7)+1×(14/6)=12.048$.
The cost per normalized unit is $12/12.048=0.996$

Normalized unit index is

$0.996/1.003×100=99.3$

Laspeyres 136.8

Paasche 85.7

Fisher 108.3

Unit 101.1

Normalized Unit 99.3

Linkage instead of Interest

Forbidden to take interest on loans.

Unfair to lender if inflation erodes value of his money.

Debt linkage can deal with this problem.

Linkage - debt and debt repayments rise and fall in proportion to some index, e.g. prices, wages, foreign currency, etc.

Which formulae for calculating indices and which methods of linkage are reasonable from both a "Torah" and scientific viewpoint ?

Accuracy and stability

Index formula should be both accurate and stable.

Stable - unrealistic prices (insignificant sales), should have little or no effect on the value of index formula.

Accuracy is both a scientific and Halachic requirement.

Stability of index formula needed for economic stability.

These matters are particularly important when debts are linked to an index formula.

Simulate and analyze situations where the true average index value is known.

Formula used for measuring wages was accurate in all our tests and analyses.

Formula used for measuring prices was accurate only when there was no correlation between price and quantity.

Formula used for measuring wages has good stability characteristics.

Formula used for measuring prices has poor stability characteristics.

Index formulae

$$L_{bi} = \frac{\Sigma_j\ p_{ij}\ q_{bj}}{\Sigma_j\ p_{bj}\ q_{bj}} \times 100 \quad - \quad \text{Laspeyre}$$

$$P_{bi} = \frac{\Sigma_j\ p_{ij}\ q_{ij}}{\Sigma_j\ p_{bj}\ q_{ij}} \times 100 \quad - \quad \text{Paasche}$$

$$F_{bi} = \sqrt{(L_{bi}\ P_{bi})} = \frac{\sqrt{(\Sigma_j\ p_{ij}\ q_{ij}\ \ \times\ \ \Sigma_j\ p_{ij}\ q_{bj}\ )}}{\sqrt{(\Sigma_j\ p_{bj}\ q_{ij}\ \ \times\ \ \Sigma_j\ p_{bj}\ q_{bj}\ )}} \times 100 \quad - \quad \text{Fisher}$$

$$U_{bi} = \frac{\Sigma_j \ p_{ij} q_{ij} / \Sigma_j \ q_{ij}}{\Sigma_j \ p_{bj} q_{bj} / \Sigma_j \ q_{bj}} \times 100 \quad - \quad \text{Unit}$$

$$N_{bi} = \frac{\Sigma_j \ p_{ij} q_{ij} / \Sigma_j \ q_{ij} m_{bij}}{\Sigma_j \ p_{bj} q_{bj} / \Sigma_j \ q_{bj} m_{bij}} \times 100 \quad - \quad \text{Normalized Unit (Lehr)}$$

where $m_{bij} = (p_{ij} q_{ij} + p_{bj} q_{bj}) / (q_{ij} + q_{by})$

(Products $p_{ij} q_{bj}$, $p_{bj} q_{ij}$ a source of instability.)

Unrealistic price - sudden price rise

Initial purchase -
Fruit basket: 2 kilos apples and 2 kilos bananas.
Prices: apples at 2 coins a kilo and bananas at 2 coins a kilo.

Most recent purchase -
Fruit basket: 4 kilos apples 0 kilo bananas.
Prices: apples at 2 coins a kilo and bananas at 4 coins a kilo.

NOTE: 4 kilos of fruit at a total cost of 8 coins are bought at both purchases.

Laspeyres   150

Paasche   100

Fisher   122

Unit   100

Normalized Unit 100

Unrealistic price - sudden price fall

Initial purchase -
Fruit basket: 4 kilos apples 0 kilo bananas.
Prices: apples at 2 coins a kilo and bananas at 4 coins a kilo.

Most recent purchase -
Fruit basket: 2 kilos apples and 2 kilos bananas.
Prices: apples at 2 coins a kilo and bananas at 2 coins a kilo.

NOTE: 4 kilos of fruit at a total cost of 8 coins are bought at both purchases.

Laspeyres   100

Paasche   75

Fisher   87

Unit   100

Normalized Unit 100

Some General Comments

Price index is based on Laspeyres index.

Wage index is based on Unit index.

Many formulae for price index, Fisher (1927) gives 134. (Many items case.)

No argument regarding wage index formula - Unit index. (Single item case.)

Wages not Prices

Linkage to prices is not a good choice.

Linkage to wages seems a good choice.

When is this Halachically acceptable?

Halachic questions

1) Are price linked loans or wage linked loans in keeping of the spirit of the biblical command of "...thou shalt not be to him as a creditor..."?

When prices increase more than wages borrowers pay more with price linkage and less with wage linkage. It therefore seems that wage linkage is in the spirit of the above biblical command, as less is taken from borrowers when they have less at their disposal. On the other hand, price linkage takes more from the wage earner borrower when he has less at his disposal and seems to contradict the spirit of the above biblical command, and this can cause wage earners hardship.

2) Would interest free wage linkage prevent erosion of the lender's money?

A mortgage bank for example, would receive a timely increase in its income when its wage bill increases.

On the basis of data we have studied, we found surprisingly that interest free loans linked to the published average wage would give an average yearly return of about 1.5% above the price index to the lender. However, if we take into account that prices and wages are measured by different index formulae, the true return is likely to be higher. Erosion of the lender's money is prevented, indeed a profit is expected, but there are risks.

3) Is linkage to the average wage akin to a reciprocal work agreement in which the works of both parties are of equal difficulty and therefore permissible?

Reciprocal work agreements in which one party does harder work than the other party violate interest laws but if the works are of equal difficulty no prohibition is raised (Shulhan Aruch Yoreh Deah 160:9). So for example if the lender worked for one month in the field for the borrower in summer when it is dry and pleasant, and in return the borrower worked for one month in the field for the lender in winter when it is cold and raining, this would violate interest laws, as work in the field in cold rainy conditions is harder than work in the field in warm pleasant conditions.

We also see from table 4 in the full paper, that the price/wage ratio is generally lower in summer than in winter, indicating that it is harder to make a living in winter than in summer. In view of this, there is likely to be objection to lending one average monthly wage in summer and collecting one average wage in winter.

However, there seems to be no objection to lending one average monthly wage in any month, and then collecting it in the same month in another year. A much better solution to this difficulty is for example, that the lender gives a loan of one average wage per month over one year and the borrower returns the loan paying one fifth of an average wage per month over five years. This is because one average wage of each of the months of the year is being lent and one average wage of each of the months of the

year is being repaid. More generally, the loan can be provided in monthly instalments over one or more full years, and repaid in monthly instalments over one or more full years.

This arrangement ensures that payments are made in terms of the average value of different kinds of labour of the whole country over one or more full years. Seasonal and regional fluctuations are thereby neutralized and the risk is lowered.

4) From an Halachic standpoint, which methods of calculating the average wage or income are acceptable for debt linkage? Which methods are to be preferred?

The unit index is used for measuring wages which seems a good choice. However, the published average monthly wage means the average gross wage per employee post of those employed. Should the nett wage be used? Should those unemployed be included in this average with an income of zero or perhaps other income such as unemployment benefit be taken into account?

Is it more correct to use the average hourly wage calculated using the formula: total gross salary paid nationally divided by total hours worked nationally? Is it more correct to use the average hourly wage calculated using the formula: total nett salary received nationally divided by total hours worked nationally? Should average monthly income be used? Should average annual income be used? Should average taxable income be used? Etc.

It seems to us that the unemployed should be included in the calculation. It also seems to us that linkage to average nett income is best in agreement with the commandment of "...לא תהיה לו כנֹשה...", and income from all sources should be taken into account.

Using the wage of the borrower

This suggestion came about as a result of discussions in the JewishBanking Google Group.

This suggestion is appropriate when lenders and borrowers are truthful, i.e. when the prophecy of Isaiah "And your people are all righteous ..." is fulfilled. It does not seem possible to use this method today when lending to the public at large. It may be possible to use it for loans in a family or in a small community, where everybody knows everybody.

Three methods

In all methods, *repayments are a percentage of the actual wage of the borrower, and there is no interest*

These methods differ regarding the debt:

Method 1: Debt as a percentage of the actual wage of the borrower

Method 2: No linkage of the debt

Method 3: Debt as a percentage of the average wage

Method 1: Debt as a percentage of the actual wage of the borrower

The debt and its repayments rise and fall in proportion to the actual wage of the borrower, and the number of repayments of the loan is fixed at the time of giving the loan. For example, the lender gives a loan of 10% of the borrower's wage in one payment. The borrower returns two instalments of 5% of his wage to the lender - be it a profit or a loss to the lender. (Detailed Examples are given below.)

A question: What return can a bank expect when lending monies to the public at large with this method?

The bank makes a return according to the increase of the total wage of the public at large or according to the increase

of the average wage of the public at large. In Israel, the average wage increases by about 1.5% a year above the price index. Therefore, a bank can expect a return of about 1.5% a year above the price index.

If the borrower's wage decreases he then pays less and if his wage increases he pays more. With this method, the bank should make a profit from all its borrowers and not from each and every individual borrower. It may be that such a method will reduce poverty and the gap between rich and poor.

Here are two detailed examples where we assume that:

1) The repayments and the debt rise and fall in proportion to the borrowers wage.

2) The borrower's wage is 10000 sheqels at the time the loan is given. The loan is 10% of this wage, i.e. 1000 sheqels.

3) The borrower repays the debt in 2 instalments of 5% of his wage at the time of repayment.

Example 1:

The borrower's wage is 5000 sheqels at the time of the first instalment and 20000 sheqels at the time of the second instalment.

He repays 250 sheqels (5% of 5000) for the first instalment and 1000 sheqels for the second instalment. Here the lender receives 1250 sheqels back and makes a profit.

Example 2:

The borrower's wage is 5000 sheqels at the time of the first instalment and 5000 sheqels at the time of the second instalment.

He repays 250 sheqels for the first instalment and 250 sheqels for the second instalment. Here the lender receives 500 sheqels back and makes a loss.

Note: With this method, a problem occurs if the borrower's wage is zero at the time of giving the loan, as the loan would be a percentage of zero - i.e. there is no loan. This problem does not occur with methods 2, 3 which follow.

Method 2: No linkage of the debt

In all examples:

1) There is no interest.
2) The lender lends 1000 sheqels to the borrower <u>without linkage of the debt</u>.
3) The borrower repays the debt in approximately 2 instalments of 5% of his wage. If the debt is not cleared in two instalments there will be an additional instalment to clear the debt.
4) The borrower's wage is 10000 sheqels at the time the loan is given, i.e. the loan is 10% of the wage, and each monthly installment is 5% of the wage.

Example 1:

The borrower's wage is 5000 sheqels at the time of the first instalment and 20000 sheqels at the time of the second instalment.

Then he repays 250 sheqels (5% of 5000) for the first instalment and 750 sheqels for the second instalment.

Note that he <u>does not</u> pay 1000 sheqels (5% of 20000) for the second instalment as the outstanding debt is only 750 sheqels.

So he borrows 1000 sheqels and returns 1000 sheqels but the actual repayments are not known at the time the loan is given.

Example 2:

The borrower's wage is 20000 sheqels at the time of the first instalment and 5000 sheqels at the time of the second instalment.

Then he repays 1000 sheqels for the first instalment and there is no further repayment.

Again he borrows 1000 sheqels and returns 1000 sheqels but there is no second repayment.

Example 3:

The borrower's wage is 5000 sheqels at the time of the first instalment and 5000 sheqels at the time of the second instalment.

Then he repays 250 sheqels for the first instalment and 250 sheqels for the second instalment and to clear the debt, an additional instalment of 500 sheqels is paid.

Again he borrows 1000 sheqels and returns 1000 sheqels but here there is an additional repayment to clear the debt.

Method 3: Debt as a percentage of the average wage

Similarly, the debt may be defined as a percentage of the average wage and the repayments as a percentage of the actual wage of the borrower. Since debt and repayments vary in different ways, this means that the repayment period can only be known approximately. Examples are not given.

The גמ״ח is more generous regarding repayments and may allow the lender to reduce or postpone repayments if the lender is in financial difficulties because of illness, loss of job etc.

A Comment regarding these three methods

With these three methods, the repayments rise and fall in proportion to the borrower's actual wage, and this is in the spirit of the biblical command "...thou shalt not be to him as a creditor...".

Conclusions and suggestions

Several reasons for using linkage to wages <u>and not</u> to prices for loans and other transactions.

Interest free wage linkage prevents erosion of the lender's money; is not oppressive to the borrower; and should be used for personal loans and mortgages.

Explained how the loan should be given so as to meet Halachic requirements and reduce the risk.

Linkage to the average wage: לא תהיה להם כנשה
Improvement to price linkage - practical solution

The Torah: לא תהיה לו כנשה

Use of borrower's wage: לא תהיה לו כנשה
Method 3 may be a practical solution in certain situations
Not as generous as the policy of a גמ״ח

Lending to the needy - policy of a גמ״ח

Change is needed
Those who honour the Torah should make such a change

Miscellaneous

All wage adjustments made in the same month(s).

Monthly and not annual adjustments to wages.

Smoothing can be used. Use a geometric mean G_i of the average wage over months i-11 to i (a 12 month period):

$$G_i = \sqrt[12]{\text{Product of average wage in months i-11 to i}}$$

After cancellation, the monthly ratio of the above geometric means for months i and i-1 would be:

$$\frac{G_i}{G_{i-1}} = \sqrt[12]{\frac{\text{Average wage in month i}}{\text{Average wage in month (i-12)}}}$$

לא תהיה להם כנשה בתווח ארוך.

Tests proposed for index formulae:

We assume I_{bi} is expressed as a pure ratio <u>not</u> as a percentage ratio (i.e. regarding these tests, the index value in the base month is 1 and not 100 as is usual). With this in mind then regardless of the formula used the following properties should hold for months b,i,k.

1) $I_{ii} = 1$.
2) $I_{bi} = 1/ I_{ib}$ for b ≠ i.
3) $I_{bi} = I_{bk} I_{ki}$ for b < k < i
4) The value of I_{bi} should be independent of the units in which quantities are expressed.

No formula satisfies properties 1,2,3,4
in the many item case.

Laspeyres and Paasche satisfy properties 1,4.

Fisher satisfies properties 1,2,4.

The unit index satisfies properties 1,2,3,4 in the single item case, but <u>does not</u> satisfy property 4 in the many item case. It is the <u>preferred</u> choice in the single item case, but is <u>unsuitable</u> for the many item case.

The normalized unit index satisfies properties 1,2,4 in the many item case. It has good stability characteristics, and is preferable to the formulae of Laspeyres, Paasche and Fisher in the many item case.