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Housing Policy and Mortgage Finance in Turkey During the Late 1990s Inflationary Period

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This paper evaluates the Turkish government's housing policy for financing the public sector housing and examines the desirability of wage-indexed payment mortgage (WIPM) contract from the lenders perspective. The WIPM contract introduced in 1998 differs from the standard index-linked mortgages in that it is based on the Civil Servant's Wage Index and there is no amortization rate. From the lender's perspective, the WIPMs are found to be desirable mortgage instruments in periods of persistent high inflation because they eliminate the real interest rate risk and credit risk of the ARM and the 'wealth risk' of a nominal FRM.

Keywords

housing policy in inflationary economies, civil servant's wage-indexed payment mortgages (WIPMs)

Introduction

The nature of the housing market, the allocation of interest rate risk, and the economic and institutional structure all contribute to the diverse mortgage contract designs that are found worldwide. Because of the volatile macroeconomic environment and the lack of legal and regulatory framework that supports collateralized lending, the provision of housing finance in developing countries is often problematic. Experience in emerging market economies has highlighted the problems with the traditional fixed rate mortgages (FRMs). Over time, the real value of the loan payment, which is constant in nominal terms, is eroded by the persistently high inflation. This decline in the real value of the payment over the term of the loan is known as *tilt* problem. Since the tilt effect increases as inflation increases, it is clear that higher levels of inflation make it more difficult for households to be qualified for loans based on their current income.

Whilst the adjustable rate mortgage (ARM) contracts enable mortgage lenders to manage moderate inflation risk, they do not perform well in periods of high inflation. First, ARMs can create major payment shocks for borrowers who suddenly find their monthly payments increasing by more than their incomes. In the last decade, the Turkish economy has experienced two financial shocks, which significantly increased the nominal interest rates (T-Bill rates and money markets rates) over the inflation rate. Thus, setting the mortgage rate based on market interest rates, as in the case of ARM, can create extremely high mortgage payments for borrowers, leading to high rates of mortgage defaults. Second, ARMs may have real interest rate risk when inflation outpaces interest rate. In Turkey, during the 1988-1999 period, the nominal interest rate increased less than the expected inflation when unexpected inflation was positive. In the 1990s periods of high unexpected inflation, the difference between the nominal interest rate and expected inflation was highly pronounced. Since the market interest rates do not always keep pace with expected inflation, lenders will have negative real return on ARM loans.

Against the backdrop of persistent inflationary pressure, the Turkish government in the late 1990s embarked upon a major housing finance reform. To address the FRM repayment tilt problem, and reduce credit risk and the real interest rate risk of the standard ARM, the government designed the index-linked payment mortgages (IL-PMs) in collaboration with a state-owned bank (Emlak Bank). The IL-PMs were originated in 1998 when the leading mortgage lender gave up lending in foreign currencies due to the devaluation of the Turkish Lira in 1994. The IL-PMs in 2001 had 44% of the total mortgage portfolio of Emlak Bank, the leading mortgage lender, in terms of the market value of the outstanding mortgage balance. Wage-

indexed payment mortgages (WIPMs) and consumer price-indexed payment mortgages (PIPMs) are the two main types of IL-PMs. Since the WIPMs have been originated more widely compared to PIPMs, which had 82% of the total IL-PMs in 2001, this paper focuses on the evaluation of the WIPM contract in vis-à-vis relation to the standard FRM and ARM contracts from the perspective of lenders.

Being outstanding balance-indexed mortgage contracts, the WIPMs differ significantly from the standard ARMs. In WIPMs, there is no contracted mortgage rate, no periodic or lifetime cap that constrains the payment adjustments and no pre-determined margin to be added to the market determined index value in this specific mortgage contract. Since the WIPMs are newly designed, there is no published academic research to our knowledge that has analysed this mortgage contract. The aim of this paper is to provide some insights into the desirability of WIPM contract for the fast growing sector of the Turkish mortgage market.

The Turkish government introduced the WIPM contracts, which are linked to the civil servants' wage rate, in order to provide affordable housing for middle-income sector of the population. Index-linked mortgages have also played an important role in facilitating long-term mortgage lending and borrowing in other countries. The two main forms of index-linked mortgages are dual index mortgages (DIMs) and price level-adjusted mortgages (PLAMs), which have been widely originated in developing economies. The PLAM contract, mainly developed in Brazil, Mexico, Israel, and Colombia, was designed to keep mortgage payments constant over the life of the mortgage by basing the initial payment on a real interest rate and then increasing the nominal mortgage payment each year by the rate of inflation. The DIM contract used in Poland, Ghana, Mexico, and Russia, amortize the loan with respect to two independent indices: an index reflecting the changing income of borrowers and a financial index that reflects the cost of funds.

Another form of indexation was the 'indexed units of account', the Unidad de Fomento (UF), which was introduced in Chile in 1967. The UF is an amount of currency that is indexed to the consumer price index (CPI). The indexation was achieved by quoting prices in a money-like unit rather than relying on an indexation formula as in the case of the PLAMs and DIMs. Ecuador also created a unit of account in 1993. Mexico and Colombia copied the Chilean UF and created a unit of value called as the Unidad de Inversion (UDI) and Unidad de porter adquisitivo consante (UPAC), respectively. Mexican banks offer UDI-denominated instruments, and UPAC is basically used for mortgage loans and for financing construction by savings. Uruguay also has a unit of account, the Unidad Rejustable (UR),

which is used to index government pension payments, and since 1996 to index government bonds. The UR is based on a wage index rather than a CPI (see Shiller, 1997).

In developed mortgage markets, indexation was also used, but not in significant numbers, to prevent the inflation-induced distortion in the housing market. Kearl (1979) made a number of proposals for changing the constant payment mortgage instrument in inflationary periods in the US economy. He points out that not all proposals would be equally effective in offsetting the inflation-induced distortion in the housing market. With the exception of index-linked contracts, variable interest rate contracts shift the risk implied by uncertain inflation to the borrower. He concluded that one of the interesting puzzles of the inflationary times in the US is the lack of development of indexed mortgage contracts. Fabozzi and Modigliani (1992), Statman (1992), Campbell and Cocco (2003) are other researchers who discussed inflation-indexed fixed-rate mortgages as alternative contracts to the conventional mortgages of the ARMs and the FRMs. Also, there is a huge US literature, mainly in the 1970s and 1980s, on price level-adjusted mortgages (PLAMs) as alternative mortgage instruments to FRMs (see Cohn and Fischer (1975), McCulloch (1986), Houston (1988), Kim (1987), and Elmer (1992)).

In Turkey, DIMs and PLAMs were widely originated in the 1970s and 1980s by two main mortgage lenders, Emlak Bank and Vakif Bank. These banks were acting as loan originators for the Housing Development Administration. In the early 1990s, the mortgages were mostly foreign currency loans denominated mainly in Deutsche Mark. The rapid expansion in the mortgage market in the early 1990s was followed by a significant turbulence in mortgage lending due to the devaluation of the Turkish Lira in April 1994. Emlak Bank, the leading mortgage lender in the country, was adversely affected by the 1994 financial crisis and ceased virtually all mortgage lending by 1995.

Focusing on the high inflation problem in Turkey, Shiller (1997) pointed out that people have serious problems in learning to adopt indexation schemes. Since government indexed debt was not introduced successfully until 1996 and the amounts are very small, Shiller posed the answer to the question: Why they do not just index the payment scheme? His basic explanation is that the theoretical relationship between the inflation and the real income is mis-specified. There is a widespread belief that inflation coincides with reversals in real incomes of ordinary people. The ‘wage lag hypothesis’, which has been refuted by economists, is alive in the public imagination. In spite of Shiller’s critics on the lack of indexation schemes, the Turkish government in cooperation with Emlak Bank re-introduced indexation in

long-term mortgage lending by originating the WIPMs.

The rest of the paper proceeds as follows: Section 2 examines the evolution of the Turkish residential mortgage market and describes its monopolistic structure. Section 3 begins by describing the mortgage lending system of Emlak Bank, which acts as a lender and developer in the residential property market, then explains the WIPM contract details and monthly payment valuation model. This section also discusses the Turkish government's housing policy for financing the public sector housing. Section 4 deals with the question 'why index-linked mortgages are preferable to the standard mortgage contracts of the ARMs and FRMs?' from the perspective of lenders. Finally, Section 5 draws some overall conclusions.

Evolution of the Turkish Residential Mortgage Market

Early 1960s to the mid-1990s

From 1960s to the mid-1990s, the housing finance system was supported mainly by three institutional organizations: Social Security Institutions, Governmental Institutions (Housing Development Administration (HDA) and Ministry of Resettlement and Construction), and Commercial Banks. Workers' social security fund, which was the most important social security institution in Turkey between 1962 and 1984, provided mortgage loans to its members that allowed for the purchase of over 230,000 housing units. In 1984, the state founded the Housing Development Administration to meet the housing demand and to develop the housing construction sector. The HDA, working through its loan originator banks of Emlak Bank, Pamuk Bank, and Vakif Bank has funded over 500,000 housing construction loans and over 250,000 long-term mortgage loans since its foundation. Lastly, commercial banks developed their mortgage loan programmes in the late 1980s as part of their consumer lending activity.

The mortgage market structure is basically monopolistic with very few lenders dominating the housing finance sector. Workers' social security fund, the leading mortgage lender of the market between the 1960s and the mid-1980s, was replaced by the HDA with its three loan originator banks from the mid-1980s to the 1990s. The commercial banks held very low percentage of mortgage loans in their asset portfolios.

Late 1990s to the early 2000s

In the early 2000s, mortgage market began to grow significantly largely as a result of a compulsory change in the investment policies of commercial banks. Until the late 1990s the government was borrowing at high rates and banks were able to earn high income by investing in government bonds. However, as the supply of high-income government bonds dried up, banks have moved into residential mortgages. Mortgage market value jumped from 70.1 billion TL in 1997 to 248.4 billion TL in 2000 and reached up to 273.6 billion TL in March 2004.[1] The market value of the mortgage loans that are denominated in US dollars ($) jumped from 290.8 million US $ in 1997 to 1.6 billion US $ in March 2004.

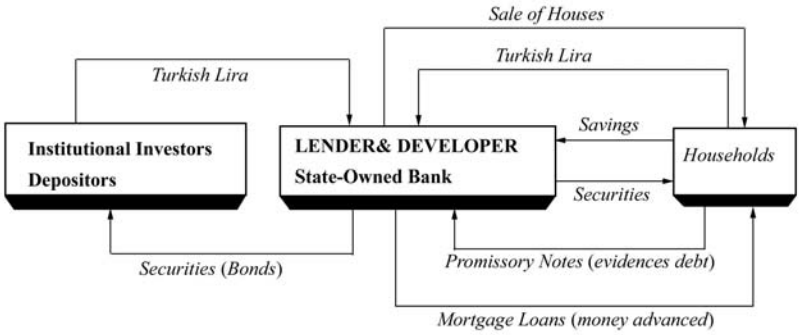
Emlak Bank and Vakif Bank, which were the main loan originators of the HDA since the mid-1980s, are still the dominant players in the mortgage market. These two state-owned banks have dominated the housing finance market during the last decade by having 87% to 97.3% of the total mortgage market value in their portfolios. HDA lost its monopoly as a housing finance institution because of the decreasing value of its fund under the weight of interest rate subsidies and its mortgage products with very low loan-to-value ratios.

Emlak Bank and Its IL-PMs

Emlak Bank[2], the government housing loan bank, has played a crucial role since 1950s. Especially during the last decade, it was the leading mortgage lender in the country with its large investments and interest in expanding its mortgage loan products. In addition to housing finance, it has two other functions of residential construction and retail banking. Turkish Banking Act states that only Emlak Bank has the legal authority to participate in joint venture of residential construction business (Fannie Mae, 1992). Being involved in residential construction sector directly, Emlak Bank acted as a lender & developer institution in the market. Figure 1 shows that the bank's mortgage lending comprises both the retail and wholesale sectors. This bank also raises funds from the sale of its own built houses. Its wholesale business is in the fund raising side only, since the funds are obtained primarily from institutional sources through the broad capital market rather than directly from the public sector. In other words, the mortgage bank originates mortgage loans, which are funded by the issue of securities.

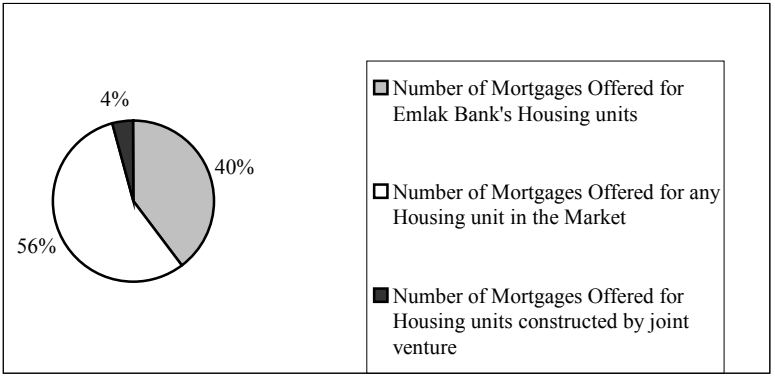
[1] The figures are real market values calculated as nominal mortgage loan values denominated in consumer price index (inflation) number of the corresponding month (December) of each year.
[2] Emlak means 'real estate' in the Turkish language.

Figure 1: Emlak Bank's mortgage lending system



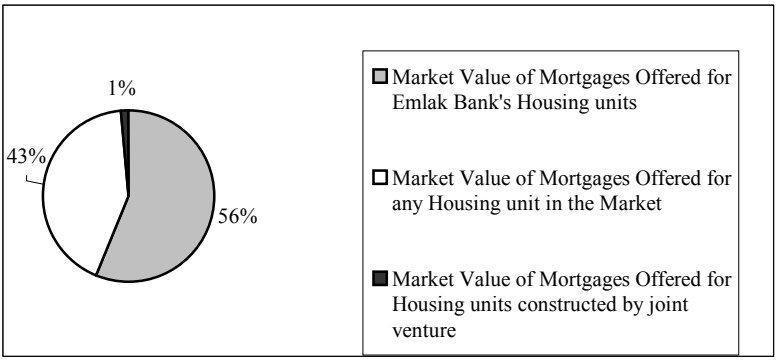
Emlak Bank offered mortgages for the purchase of three types of housing units: those constructed by Emlak Bank, those constructed by the joint venture construction business in which Emlak Bank participated with builders or developers, and those constructed by any builder in the market. As Figure 2 shows that, among these three types, dwellings constructed by individual builders in the market are the biggest part of the housing stock of the bank's mortgage portfolio. Emlak Bank's own housing construction projects have 40% of the total mortgages originated and these projects, eighteen in number, are developed in four main cities of Istanbul, Ankara, Izmir, and Adana. The market value of mortgages offered for Emlak bank's own dwellings is 56% of its total mortgage loan portfolio (see Figure 3).

Figure 2: Emlak Bank's outstanding mortgages in terms of the number of mortgage loans on 06.07.2001



* Source: Emlak Bank, Istanbul

Figure 3: Emlak Bank's outstanding mortgages in terms of the market value of mortgage loans on 06.07.2001



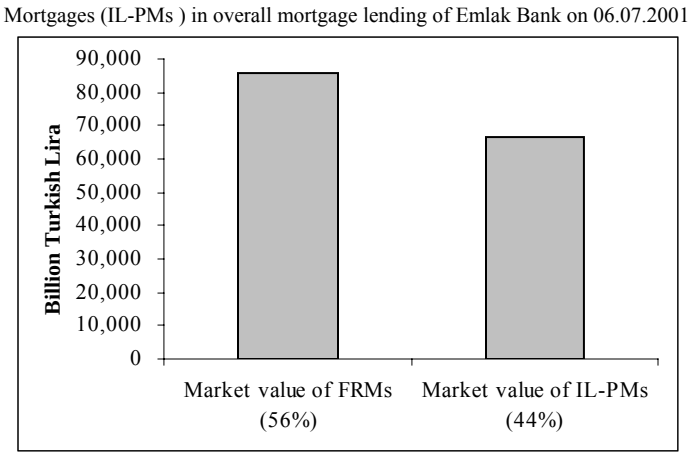
* Source: Emlak Bank, Istanbul

In terms of its mortgage products, Emlak Bank has originated basically two types of mortgages since the late 1990s: FRMs and IL-PMs of wage-indexed and consumer price-indexed. Whilst FRMs are offered as short-term loans for all three types of housing units mentioned above, the IL-PMs are created as new mortgage instruments, especially for the purchase of the bank's own housing dwellings with 10 to 15-year maturity. As seen in Figure 4, the share of IL-PMs in the overall mortgage lending is 31% in terms of the number of the mortgages originated. However, the market value of IL-PMs (outstanding mortgage balance) has a higher percentage of 44% (see Figure 5). The Emlak Bank's share of this new mortgage is 79%. It is important to note that among the IL-PMs, WIPMs are considerably larger percentage, 82%, compared to PIPMs.

Figure 4: The number of FRMs and index-linked payment mortgages (ILPMs) in overall mortgage lending of Emlak Bank on 06.07.2001

* Source: Emlak Bank, Istanbul

Figure 5: Market value of FRMs and index-linked payment



* Source: Emlak Bank, Istanbul

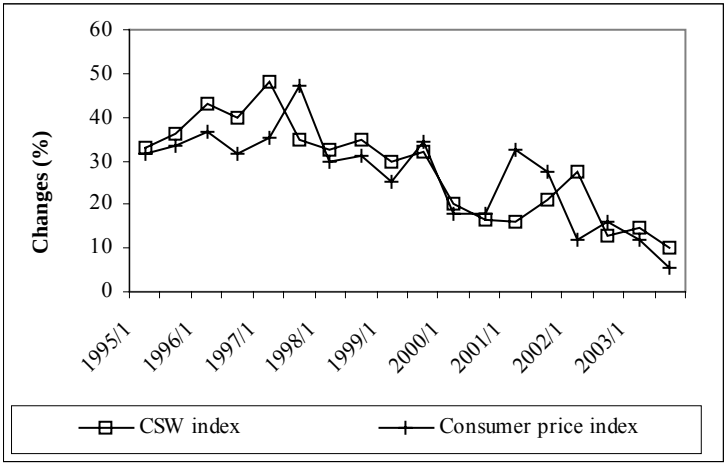
Wage–Indexed Payment Mortgage Contract

Emlak Bank originated WIPMs in 1998 that are based on one unique index, civil servant's wage (CSW) index. The WIPM has a ten-year mortgage term with an initial maximum loan-to-value ratio of 75%. Mortgage repayments are indexed to a measure of income in order to maintain the affordability of the loan to the household income. Because the repayments can vary, the loan term must also be variable to accommodate shortfalls in payments when wages are changing rapidly.

In a typical WIPM, the repayment schedule is a fixed amount, for the first six months, which is calculated by dividing the total loan amount by the mortgage term. There is no contracted, or pre-determined coupon rate to amortize the loan balance. At the end of the first semi-annual period, the remaining loan balance is adjusted semi-annually by an amount corresponding to the change in CSW index, and the new mortgage payment is calculated based on amortization of the re-valued balance over the remaining term of the loan. This process is repeated at the end of each semi-annual adjustment period until the loan is fully amortized. Thus, WIPMs, by being balance-indexed mortgages, differ significantly from the US adjustable rate mortgages by having no contracted mortgage rate. This mortgage instrument also has no periodic or lifetime caps that constrain the payment adjustments, and no pre-specified margin to be added to the current value of the CSW index.

It is important to note that there is no arrangement fee for the mortgage loans offered for the bank's own dwellings. This is because an implicit but high enough mark up already exists in the house price. On the other hand, for the housing units constructed by other developers in the market, 0.5% of the appraisal value of the house is charged at the loan origination as an arrangement fee. This amount is considerably higher compared to that charged by the UK banks, where the general charge is 0.5% of the loan amount instead of the house value. In the USA, the arrangement fee is generally 1.5% of the loan amount, which serves to discourage prepayment.

Figure 6: Semi-annual changes in CSW index and CPI between 1995 and 2003



*Source: CSW index from the Ministry of Finance and the CPI from State Statistics Institution

The monthly repayment on a WIPM mortgage, at a given semi-annual adjustment date, is calculated by multiplying outstanding balance by the civil servant's wage rate (CSWR), which is the percentage change in the CSW index. At the beginning of every January and July, the Ministry of Finance sets the CSWR in line with the expected inflation over the next six months (see Figure 6). That is,

$$\mathrm{CSWR}_{t+1} = {}_t\pi^{\mathrm{e}}_{t+1} \qquad (1)$$

The actual inflation at a semi-annual date at time $t+1$, π^{a}_{t+1}, may be higher or lower than the government's announced expected inflation at time t, that is

$$\pi^{a}_{t+1} = {}_{t}\pi^{e}_{t+1} + \varepsilon_{t+1} \tag{2}$$

where ε_{t+1} is the unexpected inflation.

$$\text{If } \varepsilon_{t+1} > 0 \quad \text{CSWR}_{t+1} < \pi^{a}_{t+1} \tag{3a}$$

$$\text{If } \varepsilon_{t+1} < 0 \quad \text{CSWR}_{t+1} > \pi^{a}_{t+1} \tag{3b}$$

If actual inflation during the semi-annual period $t+1$ is higher than what was officially expected at time t for period $t+1$, the government compensates the employees in the following semi-annual period by an amount ε_{t+1} plus an additional fixed mark-up of 2%, known as a welfare share. Although the government adjusts the civil service employees' wage rate, the mortgage repayment (MP_{t+1}) is calculated based on the expected inflation only, which is then fixed for the next six months. Thus,

$$\text{MP}_{t+1} = f\left(\text{CSWR}_{t+1}\right) = f\left({}_{t}\pi^{e}_{t+1}\right) \tag{4}$$

During the period 1996 and 2002, the house price index (HPI) and CPI were highly correlated, with the correlation coefficient of 87.65%[3]. Thus, changes in the house price index tracks the movements in the actual inflation (see Figure 7). That is,

$$\%\Delta\, HPI = HPI_{t+1} - HPI_{t} \cong \pi^{a}_{t+1} \tag{5}$$

$$\text{If } \varepsilon_{t+1} > 0 \quad HPI_{t+1} \cong \pi^{a}_{t+1} > {}_{t}\pi^{e}_{t+1} \tag{6a}$$

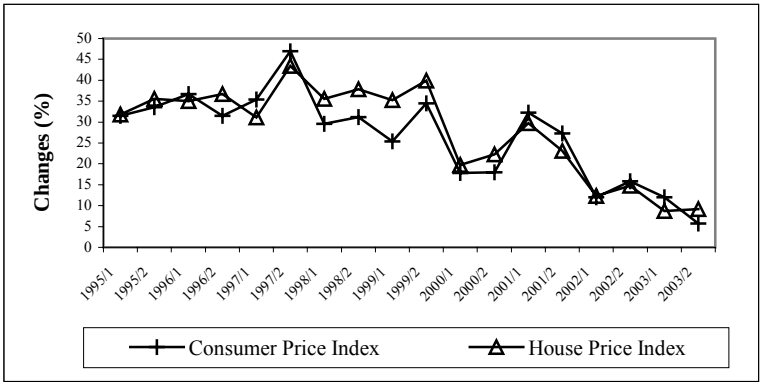
$$\text{If } \varepsilon_{t+1} < 0 \quad HPI_{t+1} \cong \pi^{a}_{t+1} < {}_{t}\pi^{e}_{t+1} \tag{6b}$$

Under the circumstances that six-month cumulative value of actual inflation outpaces the expected inflation, and therefore the CSW index, (see Eq. (6a)), there is no incentive for borrowers to default on their mortgages. This is because, firstly, their outstanding debt amount is adjusted to the CSW rate, which is lower than the actual inflation rate, and secondly, the increase in HPI is greater than the CSW rate. However, for the lender the real return is negative when $\pi^{a}_{t+1} > {}_{t}\pi^{e}_{t+1}$. This is precisely what happened in the first half of 2001 when the expected inflation rate ${}_{00/2}\pi^{e}_{01/1}$, and so the $\text{CSWR}_{01/1}$, was set at 15.9%, while the actual inflation rate $\pi^{a}_{01/1}$ was 32.32%. Conversely, if the actual inflation is lower than the expected inflation rate

[3] The significantly high correlation between house prices and the inflation is calculated using the house price index (HPI) and consumer price index (CPI), which are both published monthly by the State Statistics Institution.

(see Eq. (6b)), the lenders realise an unexpected gain. However, a lower value of π^{a} increases the borrowers' incentive to default on their mortgages because they bear the burden of a considerably higher amount of mortgage repayment at a time when house price index has declined sharply. This was actually the case in the first half of 2002, when the expected inflation rate ${}_{01/2}\pi^{e}_{02/1}$, and also $\mathrm{CSWR}_{02/1}$, was set as 27.68% while the actual inflation rate $\pi^{a}_{02/1}$ was 12.09%.

Figure 7: Semi-annual changes in HPI and CPI between 1995 and 2003



*Source: State Statistics Institution, Ankara

Modeling Monthly Payments Valuation

To describe the process of semi-annually adjusted mortgage repayments, we introduce the following notation:

L = the total loan amount;
n = the mortgage contract maturity in terms of months;
i = the i-th adjustment period for mortgage payment;
the total number of adjustment periods = n / reset frequency.
Thus, $i = 1, 2, ..., I$, where $I = 120 / 6 = 20$.
j = the j-th monthly payment date in the i-th adjustment period, where $0 \le j \le 6$
$\mathrm{OB}(i,j)$ = outstanding balance after the payment at (i, j);
$W_{(i,0)}$ = semi-annual cumulative increase in CSW index (expected inflation rate) for the first six months of the i-th adjustment period;
MP_i = the monthly payment of the mortgage at the i-th adjustment period;

η_i = the number of remaining months from adjustment period's beginning to the contract maturity;
for $i = 1$, $\eta_1 = n$
for $i = 2$ to 20, $\eta_i = \eta_{i-1} - 6$.

The value of each monthly mortgage payment MP is determined in order to allow the principal to be paid in full by the end of the contract term. In a WIPM contract, the first period of the contract (for the first six months) mortgage repayment schedule is a fixed amount, which is calculated by dividing the total loan amount by the mortgage term, and there after at each monthly payment date, the outstanding balance of the borrower's debt decreases by the fixed amount of MP.

$$\mathrm{MP}_i = \frac{L}{\eta_i}, \qquad \text{where } \eta_i = n \tag{7}$$

$$\mathrm{OB}(i, j) = \left[L - \left(\mathrm{MP}_i \cdot j \right) \right] \qquad \text{for i} = 1, j = 0,...,6 \tag{8}$$

From the beginning of the second period, mortgage repayment schedule behaves as an adjusted payment mortgage, and the outstanding balance is adjusted semi-annually in line with change in CSW rate. Monthly payments are calculated as

$$\mathrm{MP}_i = \left[\mathrm{OB}(i,0) \cdot \frac{\left(1 + W_{(i,0)}\right)}{\eta_i} \right] \qquad \text{for } i = 2,3,\ldots, I \tag{9}$$

Thus, $\mathrm{OB}(i,0) * \left(1 + W_{(i,0)}\right)$ is the CSW rate-adjusted outstanding balance that determines the monthly payments with time to maturity parameter, and $\mathrm{OB}(i,0) = \mathrm{OB}(i-1,6)$ implies that the remaining OB at the end of the 6^{th} month of adjustment period $i-1$ equals to the outstanding balance at the beginning of period i. The outstanding debt amount after the payment date $t(i, j)$ is

$$\mathrm{OB}(i, j) = \left[\mathrm{OB}(i,0) \left(1 + W_{(i,0)}\right) \right] - \left(\mathrm{MP}_i \cdot j \right) \tag{10}$$

and note that for $i = 2$, $\mathrm{OB}(2,0) = L - \left(\mathrm{MP}_1 \cdot 6 \right)$.

The repayment scheme of a typical WIPM contract is presented in Table 1. In order to calculate monthly payments the future paths of CSW index are simulated by Monte Carlo simulation method. It is important to note that future repayments are estimated based upon the basic assumption that the

CSW rate follows a mean-reverting square root diffusion process (see Appendix for details).

A ten-year simulation for the CSW index is performed for the period 2003 and 2012.[4] The base parameter values that describe the CSW index paths are the wage rate volatility, σ_W = 15% and the long-term average value of wage rate, θ_W = 24%. These values are calculated using the CSW index data from 1995-2003, which are published by the Ministry of Finance. Over the sample period, the CSW index has an upward sloping trend since the initial wage rate is taken to be 14.5%, while the long-term average rate is set as 24%. This is because in years 2002 and 2003, the inflation has been reduced significantly to 29.7% and 18.4% per annum respectively, resulting in low values of CSW index in these years. It is the high inflation rate, between1996 and 2001, that makes the long-term average wage rate to be a relatively high figure, that is 24% per semi-annum period. Lastly, the long-term mean reversion rate for the CSW index, κ, is assumed to be 30%, which is higher than the generally accepted values in the literature.[5] This is because the economic environment in Turkey is highly volatile in comparison to the US and the UK markets.

Table 1 presents a WIPM amortization example. In the first semi-annual period, after the loan is issued, the monthly payment is calculated by dividing the original loan amount, 15 billion Turkish Lira (TL) to 120, which is the contract maturity in number of months. Thus the monthly payment is 125 million TL, and the borrower will pay the lender 750 million TL for the next six months. In the second period, the borrower will pay 128.65 million TL per month. This amount is calculated firstly by increasing the remaining loan balance, 14.25 billion TL, by CSW rate that is 30% as indicated in Table 1. Then, dividing the CSW-indexed balance to the remaining number of months to maturity, that is 114. And the borrower will pay the lender 771.875 million TL for the second semi-annual period.

[4] Since the WIPMs were originally issued in the second half of 1998, the actual CSW index values are used for the first four years of repayment scheme, then the simulated path, from 2003 to 2008, is used in order to calculate the monthly repayments on a WIPM.

[5] In the US literature, it is generally accepted that interest rates, which follow mean-reverting square root diffusion process, converge towards the long-term mean value with the rate ranges from 10% to 25%. Titman and Torous (1989) estimated the mean reversion rate as 25%. Whilst, Kau *et al* (1990) used 15% long-term mean reversion rate in pricing the ARMs in their following research Kau *et al* (1993) used 25% as the speed of adjustment to the long-term mean value. On the other hand, DeFranco (2002) accepted the mean reversion rate as 10%.

Table 1: An example of the WIPM amortization

House price at origination	20 billion TL
Loan amount	15 billion TL
Loan-to-value (LTV) ratio	75 %

	Real semi-annual payments in billion TL	Real outstanding balance in billion TL	Nominal outstanding balance in billion TL	CSW rate (%)	CSW-indexed outstanding balance in billion TL	Nominal semi-annual payments in billion TL
20 Jul 1998	0.75	15	15		15	0.75
20 Jan 1999	0.75	14.25	14.25	30	18.53	0.77
20 Jul 1999	0.75	13.5	17.75	32	23.43	1.30
20 Jan 2000	0.75	12.75	22.13	20	26.56	1.56
20 Jul 2000	0.75	12	25	16.3	29.07	1.82
20 Jan 2001	0.75	11.25	27.25	15.9	31.59	2.11
20 Jul 2001	0.75	10.5	29.48	21.6	35.85	2.56
20 Jan 2002	0.75	9.75	33.29	27.68	42.50	3.27
20 Jul 2002	0.75	9	39.23	12.7	44.22	3.69
20 Jan 2003	0.75	8.25	40.53	14.5	46.41	4.22
20 Jul 2003	0.75	7.5	42.19	16.12	48.99	4.90
20 Jan 2004	0.75	6.75	44.09	17.72	51.90	5.77
20 Jul 2004	0.75	6	46.14	19.3	55.04	6.88
20 Jan 2005	0.75	5.25	48.16	20.73	58.15	8.31
20 Jul 2005	0.75	4.5	49.84	21.2	60.41	10.07
20 Jan 2006	0.75	3.75	50.34	22	61.41	12.28
20 Jul 2006	0.75	3	49.13	23	60.43	15.11
20 Jan 2007	0.75	2.25	45.32	23.84	56.13	18.71
20 Jul 2007	0.75	1.5	37.42	24.5	46.58	23.29
20 Jan 2008	0.75	0.75	23.29	25.3	29.19	29.19
20 Jul 2008		0				

The semi-annual payment streams are shown in Figure 8. The real payments are fixed at 750 million TL over the life of the loan, however, the nominal payments on a WIPM contract increases at an increasing rate every period. The nominal semi-annual payments begin at 750 million TL and soar to 29.2 billion TL in the last semi-annual period of the WIPM contract. One year after the loan origination, the nominal annual payment increases by 88.2%. Over two-year period, payments increase by more than 150% per annum, and by the last year of the contract annual payment is 34.5 times greater than the initial payment in 1998. The time paths of the remaining balances are shown in Figure 9. Whilst the real balance declines continuously, the nominal balance increases until it peaks at 50.337 billion TL in January 2006, following the 15^{th} payment. Then it begins to decline and reaches zero following the20^{th} payment. The WIPM borrower owes 3.36 times the initial principal in the first half of 2006 when the loan balance reaches to its peak value.

Figure 8: Semi-annual mortgage payments on a ten-year WIPM contract

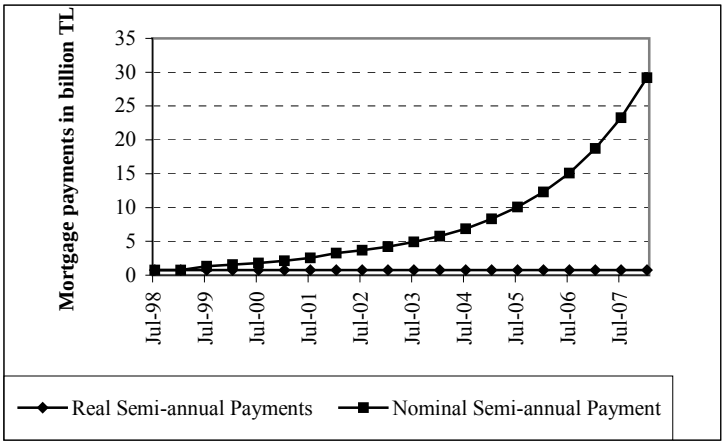
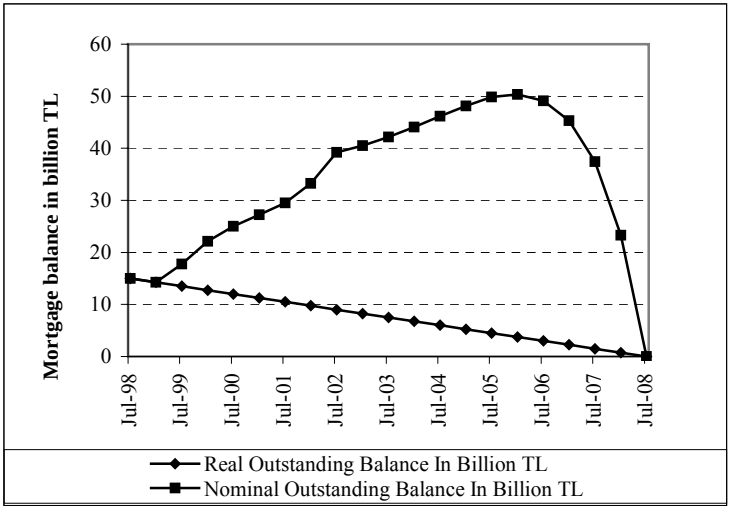


Figure 9: Mortgage loan balance over ten-year WIPM contract



Why Choose Index-Linked Mortgages? : Lender's Perspective

In an environment with uncertain inflation, a nominal FRM, without a prepayment option, is an extremely risky contract because its real capital value is highly sensitive to inflation. The presence of a prepayment option protects the borrower since she can call the mortgage at face value if nominal interest rates fall, and take out a new mortgage contract with a lower nominal rate. However, this option raises the interest rate on an FRM and leaves the borrower with a contract that is expensive when inflation is stable, but extremely cheap when inflation increases. This is called as 'wealth risk', an important disadvantage of a nominal FRM under inflationary environment (see Campbell and Cocco, 2003). That is why the FRMs are originated as low loan-to-value loans for short-term maturities of at most three years in the Turkish mortgage market.

An ARM in contrast is a safe contract in the sense that its real capital value is almost unaffected by inflation. In developed mortgage markets, the lenders generally prefer ARMs because all (or most) interest rate risk is shifted to the borrowers. Whilst ARMs have a better match for depository portfolio lenders, they may have higher credit risk due to the potential payment shocks, especially in the inflationary periods. Campbell and Cocco (2003) stated that the risk of an ARM is the 'income risk' of short-term variability in the real payments that are required each month. According to the authors, if expected inflation and nominal interest rates increase, nominal mortgage repayments increase proportionally even though the price level has not changed much; thus real monthly payments are highly variable. As a result, this variability would result in mortgage defaults if the borrower faces borrowing constraints with low income and low house prices.

There are two basic reasons why mortgage lenders in Turkey have originated index-linked mortgages rather than ARMs. First, the IL-PMs can eliminate the real interest rate risk of the ARMs in periods of high inflation. Based on the Fisher Hypothesis, Berument and Malatyali (1999) analysed the behaviour of the Turkish Treasury interest rates. In their regression of interest rate on expected and unexpected inflation[6], found that both coefficients of expected inflation and inflation risk are statistically significant. The findings reveal that while the interest rate is positively related to expected inflation and unexpected inflation, the interest rate increases less than expected inflation. This finding supports the main result of Tobin's (1965) study that high inflation has an adverse effect on real

[6] Berument and Malatyali (1999) proxy the inflation risk with the conditional standard deviation of inflation rate and estimate the conditional variance of inflation using a GARCH model.

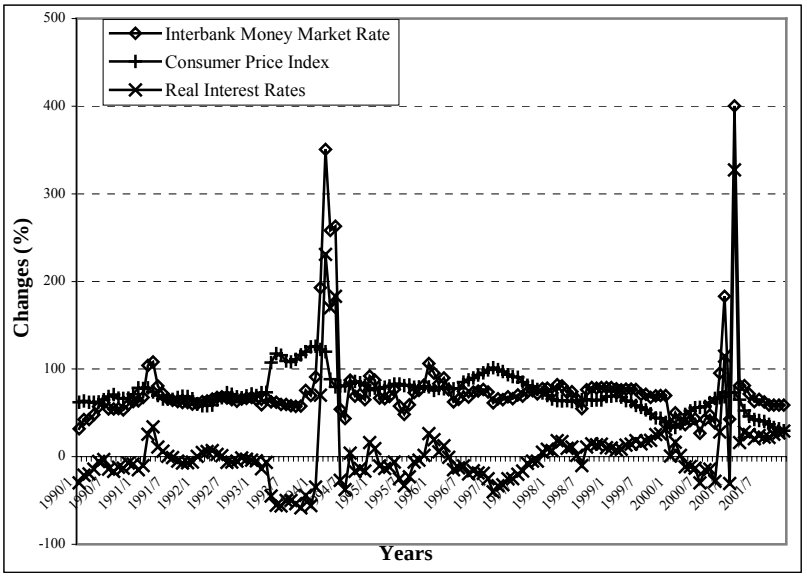
interest rate. Since the nominal interest rate does not fully capture the expected inflation, the ARM would not be profitable for lenders whilst WIPMs, which are indexed to expected inflation, provide better inflation hedge than ARM.

The real interest rates in Turkey may even become negative (see Figure 10). The report by Fannie Mae (1992) on housing finance system in Turkey analyzed different mortgage instruments originated in the 1970s. They calculated 15-year maturity ARM repayment schedule (starting in 1970) with a mortgage rate based on a 1% point spread over the bank discount rate. The result was declining ratio of payments to household income and negative real return to the mortgage lenders. This was mainly because real interest rates in Turkey during the period were negative. Although adjustments to interest rate covered some of the effects of the inflation, there was substantial erosion of the real value of the loan when inflation exceeded the bank discount rate by 20% points. The report concluded that, not all interest rate indices accurately track inflation and real cost of funds. Thus the use of an interest rate index that more accurately tracks inflation would improve performance of the ARM.

Second, Turkish economy has experienced two big financial crises and macroeconomic volatility in 1994 and 2001. The ARMs became highly problematic during these periods of crises. As Figure 10 shows, the monthly inter-bank money market rate peaked at almost 350% and 400%, and the T-Bill rate peaked at 159% to 120%, in the first half of 1994 and 2001 respectively, when the inflation rate was between 119% and 73% in these periods[7]. Because the financial crises significantly increased the nominal interest rate over the inflation rate, fixing the mortgage rate to either the inter-bank rate or the T-Bill rate would result in nominal payment shocks leading to high rates of mortgage defaults. This was indeed the case in Mexico between 1986 and 1995. During this period, almost all mortgages in Mexico were dual index mortgages (DIM), a special form of adjustable interest rate loan. The monthly amount owed on the DIM loan was indexed to either the average cost of funds for all Mexican banks or 28-day Mexican Treasury notes. As the interest rate soared during this period, mortgage defaults reached a record number in 1995 (Lipscomb and Hunt (1999) and Lea (1996)).

[7] Since the Treasury bills were not continuously used by the Turkish government, Figure 10 does not include T–Bill rates. The data on T-Bill rates are from February 1994 to January 1996 and from January 1999 to December 2002.

Figure 10: Annual market interest rate and inflation (CPI) movements in Turkey between 1990 and 2002



* Source: Consumer price index (CPI) from State Planning Organisation (DPT) and Interbank Money Market Rate from International Financial Statistics (IFS) prepared by the International Monetary Fund (IMF).

Thus, the ARMs do not perform well with high and volatile inflationary environments. Using market interest rates as the ARM rate in a high inflation economy like Turkey may result in either payment shocks for borrowers, who suddenly find their monthly payments increasing more than their incomes, leading to high credit risk for lenders or decreasing and even negative real interest rates, when inflation rate outpaces the increases in nominal interest rates, leading to real interest rate risk for mortgage lenders. It should be noted that using interest rates in other commonly used index-linked contracts of the PLAMs and DIMs may also result in either decreasing returns or very high default risk. Because it is the market interest rate index, with its highly volatile real values that would amortize the mortgage loan balance or determine the annual repayments in these mortgage contracts.

Hence, the WIPMs have become more popular mortgage instruments in comparison to the FRMs and ARMs and even to the widely used PLAMs and DIMs; therefore, they were widely originated in four main cities in the country.

Conclusion

Turkey, as a developing country, has a highly volatile inflationary environment, in which low- and middle-income households have no or limited access to mortgage financing. Turkish residential mortgage market has a monopolistic structure with a few dominant players (two state-owned banks) in the housing finance sector. In the early 1990s, the long-term mortgages were mainly foreign currency loans denominated in the Deutsche Mark and the US Dollars. Following the devaluation of the Turkish Lira in April 1994, the leading mortgage lender, Emlak Bank, ceased all its mortgage activity and in 1998 the bank introduced index-linked payment mortgages in collaboration with the government.

Wage-indexed mortgages have been widely originated in four biggest cities, in comparison to the consumer price-indexed mortgages, by having 82% of the total IL-PMs. The WIPMs completely differ from the 'indexed units of account' mechanism that is widely used in other high inflation countries. By relying on an indexation formula, the WIPMs are more similar to the PLAMs and DIMs. However, the lack of an interest rate to amortize the loan balance makes the WIPM contract different even from the index-linked mortgages of PLAMs and DIMs. Being outstanding balance-indexed mortgages, the WIPM has no market interest rate risk. Since the mortgage repayments on a WIPM vary with the CSW index and ultimately with the underlying change in economic conditions in Turkey, the WIPM contract provides the lenders an asset whose real value is almost unaffected by inflation. This specific mortgage contract also enables the borrower to reduce the mortgage repayment risk by facilitating repayments that are contingent on to her wage income. Thus, the WIPM can be an effective housing finance instrument with its design objective of balancing borrower affordability and lender profitability.

It can be concluded that the WIPM removes the wealth risk of the nominal FRM without having the real interest rate risk and the credit (repayment) risk of the ARM, and therefore, it seems to be a preferable mortgage instrument in an inflationary economy. If the high inflationary environment persists in the future, the use of WIPM contracts will become even more widespread. The success and usefulness of this mortgage instrument depends not only on the contract design itself, but also on the correct set of supporting actions and policies by government and financial institutions. Emlak Bank created the WIPM contract as a specific mortgage design for middle-income civil servants, who are the main group of borrowers of housing loans with their state guaranteed salaries, and the Turkish government introduced a policy target to keep the movements in the CSW index in line with the CPI. Thus, by creating a wage index that keeps pace

with inflation, the government facilitated long-term mortgage lending and borrowing.

Appendix

It is assumed that the CSW index evolves according to a mean reverting square root process. Care must be taken when choosing the process to describe the dynamics of CSW index. First, the mean reverting process (MRP) has been used extensively in the valuation models for interest rate sensitive and inflation, CPI, sensitive contingent claims. According to Buetow and Albert (1998), MRP processes are appropriate for positive economic variables that tend toward a long-run mean but experience short-term disturbances, so they are often used to model interest rates and the inflation rate. Since the CSW index has the same dynamics as the expected inflation in Turkey, we model the dynamics of CSW rate using a mean reverting square root process. As stated by Buetow and Albert (1998) in valuing inflation-indexed financial contracts, any index can be used as it exhibits similar stochastic properties to the CPI.

The second reason for choosing the mean reverting square root process for the CSW index is that an increase in wage rates can be interpreted as a yield on human capital. In a two-factor oil contingent claims pricing model, Gibson and Schwartz (1990) use spot price of oil and convenience yield on crude oil, which is assumed to follow a mean reverting process. They view the convenience yield as a net dividend yield accruing to the owner of the physical commodity of crude oil. Analogously, for pricing wage indexed mortgage contracts, the wage level can be defined as the yield on human capital. Thus, the changes in CSW index are simulated based on the risk-neutralized stochastic process using the difference equation of

$$W_{t+\Delta t} = W_t + \kappa\left(\mu - W\right)\Delta t + \sigma_{\mathrm{W}}\sqrt{W}\sqrt{\Delta t}\varepsilon\,, \qquad \varepsilon \sim N(0,1) \tag{A1}$$

where, μ represents the long-term mean value for the changes in CSW index, κ is the speed of adjustment in the mean reverting process, σ_{W} denotes the instantaneous standard deviation of the wage rate disturbance, and $\sqrt{\Delta t}\varepsilon$ is the standardized Wiener process. It is important to note that only positive nominal wage rates (or expected CPI) with the square root term are taken in the Monte Carlo step (see Beaglehole and Tenney, 1992: 346-347 for details).

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