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"The Effects of Permanent Inflation Stabilization on Firms´Debt Maturity: a Case Study of Argentina."

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THE EFFECTS OF PERMANENT INFLATION STABILIZATION ON FIRMS' DEBT MATURITY: A CASE STUDY OF ARGENTINA

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1. INTRODUCTION AND MOTIVATION

The idea that the maturity of financial contracts tends to be shorter in high inflation environments than it is in stable ones, is not new in the economics profession. Among academics, the idea can be found in advanced, or even elementary textbooks[1]. Among practicioners, the phenomenon is well known as well[2]. In particular, the developments that took place in the Argentine financial system have attracted the attention of both academicians and policymakers. Consider, first, the following passage taken from Cavallo (PhD dissertation, Harvard University, 1977):

"Before persistent inflation get started, Argentina had a reasonably well developed financial system. A very active market for public bonds and private securities did exist, as well as a well-developed capital market, and commercial banks issued long-term certificates of deposits that permitted them to finance long-term loans to farmers and entrepreneurs"

Consider, next, the following passage taken from the Recent Economic Developments IMF document for Argentina in 1984 (p.36):

"The persistence of high inflation in Argentina has made financial markets extremely volatile as the bulk of transactions has tended to be at very short-term positions -typically between 7 and 30 days for free operations and for regulated-rate deposits- and at various times the authorities have

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* Comments received from Roger Betancourt and Francisco Rodríguez were extremely helpful. I bear sole responsibility for the contents of this paper, however.

[1] Heymann and Leijonhufvud (1995), especially chapters 3 and 5, and Krugman and Obstfeld (1996, page 388), respectively, provide illustrative examples.

[2] See, for instance, E. Rojas and P. Rodríguez (1997, especially pages 42-43) for the case of Venezuela, or the IMF Recent Economic Developments (year 1983, page 31; year 1989, pages 42-43) for the case of Peru.

established instruments (including indexed deposits and loans) with a view to lengthening the term of operations".

Some recent studies have analyzed the effects of high inflation on the financial system[3], but, somewhat surprisingly, no systematic study of the behavior of long-term debt has been done so far *at the level of the firm*, to the best of my knowledge[4].

In this paper, I test the hypothesis that the ratio **long-term debt/ total debt** tends to be lower for firms operating in high inflation environments, than for firms operating in low inflation environments. The idea that underlies this hypothesis is very simple: the higher degree of uncertainty that prevails in a high inflation economy leads firms to shorten the maturity of debt, in equilibrium[5].

2. DATA AND METHODOLOGY

Using firm-level data from the International Financial Corporation (IFC) and the Worldscope databases, I apply the *treatment-control methodology* to get a *difference-in-difference estimate* of the increase in long-term corporate debt after a permanent stabilization of inflation takes place. The control group consists of Mexican firms operating in a high inflation regime (2 digit inflation on an annual basis) for seven consecutive years during the mid 1980s and the early 1990s. The treatment group consists of Argentine firms operating in a high inflation regime during the first three years of the proposed experiment, and in a low inflation regime during the last four years of the experiment. It is probably worth recalling that a major stabilization program took place during 1991 in Argentina, that permanently brought the inflation rate down to zero. No such a development took place in Mexico.

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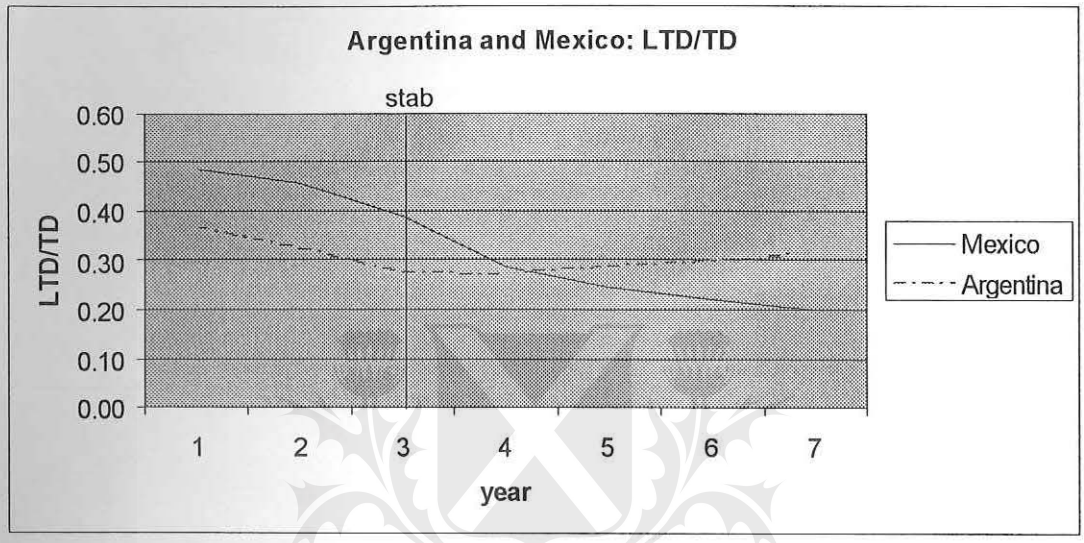
[3] A recent paper on the effects of inflation *on the financial system* is the one by Boyd, Levine, and Smith (2000).

[4] Demirguc-Kunt and Maksimovic (1999) present some very preliminary cross-country evidence that long-term corporate debt tends to be negatively related to inflation, but the focus of their study is not on the effects of inflation.

[5] Neumeyer (1998) constructs a general equilibrium model that rationalizes this fact. A simpler, partial equilibrium, framework that also accounts for this fact is provided by Guerrero (2000).

The following graph shows the time pattern that the ratio long-term debt/total debt followed in both the treatment and control groups. The chart clearly shows that before stabilization took place in Argentina, the ratio (LTD/TD) followed a very similar pattern for both the Mexican and the Argentine firms. However, as long as stabilization takes place in Argentina, the patterns start to diverge, as expected.



The purpose of the exercise is to get an unbiased estimate of the increase in (LTD/TD) for the Argentine firms after stabilization takes place. The control group is included to construct a counterfactual scenario for the Argentine firms (i.e., what would have happened in the absence of intervention), detrending the ratio corresponding to the Argentine firms from its secular component. In this way, I avoid attributing to stabilization the part of the change in (LTD/TD) that is due to the secular trend that the data for the Argentine firms exhibits before stabilization takes place.

The following table presents the numbers used to construct the graph depicted above.

TABLE 1

	TREATMENT GROUP LTD/TD	CONTROL GROUP LTD/TD
year 1	0.37	0.48
year 2	0.33	0.46
year 3	0.27	0.39
year 4	0.27	0.29
year 5	0.29	0.25
year 6	0.30	0.22
year 7	0.32	0.20

The diff in diff estimate of the effect of stabilization on firms' (LTD/TD) is a Two Ways Fixed Effect procedure that utilizes the variation in the data in both the control and the treatment groups[6]. Table 2 summarizes the idea.

TABLE 2

	BEFORE	AFTER	DIF.
TREATMENT	0.32	0.29	-8.85%
CONTROL	0.44	0.24	-46.31%
		DIF.in DIF. ESTIMATE	37.46%

Following Schmukler and Vesperoni (2000), (LTD/TD) is explained with a vector of standard corporate finance determinants[7]. Descriptive statistics are provided below.

[6] The One Way Fixed Effect estimates for all the regression exercises presented in this paper are available upon request from the author.
[7] See the appendix for the definition of variables.

TABLE 3: SUMMARY STATISTICS

ARGENTINA		Mean	Std. Dev.	Min	Max	Observations
ltdtd	overall	.2912317	.2359751	0	.8905493	N = 298
	between		.1983816	0	.6585236	n = 68
	within		.1304376	-.2280973	.7779006	T-bar = 4.38235
lnfa	overall	.4962022	.0523659	.3332202	.6325203	N = 299
	between		.0488594	.3375015	.6209346	n = 69
	within		.0184595	.3722738	.5604819	T-bar = 4.33333
nfata	overall	.4426295	.2237052	.0007951	.9196892	N = 299
	between		.2190459	.0029679	.9085047	n = 69
	within		.0692075	.0753652	.8218163	T-bar = 4.33333
nsnfa	overall	3.670549	15.52981	.0142829	243.5481	N = 295
	between		12.2906	.0142829	102.7537	n = 69
	within		10.06509	-85.25375	144.465	T-bar = 4.27536
pta	overall	.0181822	.1098222	-.5328916	.374442	N = 299
	between		.0800025	-.2040374	.1831369	n = 69
	within		.0778335	-.3899895	.2765546	T-bar = 4.33333
MEXICO		Mean	Std. Dev.	Min	Max	Observations
ltdtd	overall	.324481	.2770735	-.0019735	.9563043	N = 666
	between		.2097266	0	.8644658	n = 115
	within		.1828848	-.2854342	.8404174	T-bar = 5.7913
lnfa	overall	.7582097	.1215169	.4188006	1	N = 221
	between		.1170502	.5313228	.9845624	n = 45
	within		.0639027	.6003441	.8910508	T-bar = 4.91111
nfata	overall	.5691991	.161089	.072475	.9615187	N = 401
	between		.148159	.2377594	.9467828	n = 76
	within		.0674794	.066301	.755356	T-bar = 5.27632
nsnfa	overall	1.518667	1.253637	.0455612	11.18144	N = 401
	between		1.004271	.0712596	4.522621	n = 76
	within		.7035486	-.5194618	10.04662	T-bar = 5.27632
pta	overall	.0536619	.0666138	-.3377416	.3752403	N = 665
	between		.0451472	-.0692658	.1957784	n = 115
	within		.0501224	-.2832627	.3655238	T-bar = 5.78261

3. RESULTS

Table 4 below presents the Two Ways Fixed Effect estimate of the impact of permanent stabilization on (LTD/TD). The ratio (LTD/TD) is regressed against a standard vector of corporate finance determinants and a dummy variable (stab) that takes value equal to one for the Argentine firms after stabilization and zero elsewhere.

TABLE 4

```
Fixed-effects (within) regression               Number of obs      =       513
Group variable (i) : id                         Number of groups   =       113

R-sq:  within  = 0.1461                         Obs per group: min =         1
       between = 0.0603                                        avg =       4.5
       overall = 0.0243                                        max =         7

                                                F(11,389)          =      6.05
corr(u_i, Xb)  = -0.7296                        Prob > F           =    0.0000

------------------------------------------------------------------------------
      ltdtd |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
------------+-----------------------------------------------------------------
       lnfa |   -1.04787   .1581392    -6.626   0.000    -1.358784   -.7369556
      nfata |   .2415098   .1036729     2.330   0.020     .0376806    .445339
      nsnfa |   .0005287   .0024969     0.212   0.832    -.0043804    .0054378
        pta |  -.0263727   .1143557    -0.231   0.818    -.2512053    .1984599
       stab |   .0882467   .0350751     2.516   0.012     .0192861    .1572072
     Iyear_2 |   .0045472   .0259352     0.175   0.861    -.0464436    .0555379
     Iyear_3 |   .0990787   .0293674     3.374   0.001     .0413401    .1568173
     Iyear_4 |   .0346901   .0300549     1.154   0.249    -.0244004    .0937805
     Iyear_5 |   .0426247   .0298338     1.429   0.154     -.016031    .1012804
     Iyear_6 |   .0619183   .0356302     1.738   0.083    -.0081336    .1319702
     Iyear_7 |   .0431131   .0422373     1.021   0.308    -.0399289    .1261552
       _cons |   .7527131   .1023757     7.352   0.000     .5514341    .9539921
------------------------------------------------------------------------------
     sigma_u |  .32802423
     sigma_e |  .14304079
         rho |  .84022662   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(112,389) =     8.73                 Prob > F = 0.0000
```

As Table 4 shows, stabilization is a statistically significant variable that helps to explain the increase in (LTD/TD) for Argentine firms, after controlling for the effects of corporate finance determinants on firms' long-term debt.

For completeness, Table 5 below reports the Random Effect estimation results.

TABLE 5

```
Random-effects GLS regression                   Number of obs      =       513
Group variable (i) : id                         Number of groups   =       113

R-sq:  within  = 0.0626                         Obs per group: min =         1
       between = 0.0130                                        avg =       4.5
       overall = 0.0397                                        max =         7

Random effects u_i ~ Gaussian                   Wald chi2(11)      =     24.92
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.0094

------------------------------------------------------------------------------
      ltdtd |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
------------+-----------------------------------------------------------------
       lnfa |  -.1690982   .1146404    -1.475   0.140    -.3937892    .0555928
      nfata |   .3244159   .0801436     4.048   0.000     .1673373    .4814946
      nsnfa |   .0018608   .0022222     0.837   0.402    -.0024946    .0062162
        pta |   .0550803   .1100942     0.500   0.617    -.1607005     .270861
       stab |   .0457739   .0352678     1.298   0.194    -.0233498    .1148976
    Iyear_2 |  -.0306504   .0269903    -1.136   0.256    -.0835505    .0222497
    Iyear_3 |   .0321169   .0292532     1.098   0.272    -.0252182    .0894521
    Iyear_4 |  -.0243033   .0305897    -0.794   0.427    -.0842579    .0356514
    Iyear_5 |  -.0216302   .0302577    -0.715   0.475    -.0809342    .0376738
    Iyear_6 |  -.0041724   .0366103    -0.114   0.909    -.0759272    .0675824
    Iyear_7 |  -.0223345   .0435713    -0.513   0.608    -.1077326    .0630637
      _cons |   .2370262   .0769533     3.080   0.002     .0862004    .3878519
------------+-----------------------------------------------------------------
    sigma_u |  .18454874
    sigma_e |  .14304079
        rho |  .62470508   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

If this specification were the correct one, even when having the correct sign, stab would not be statistically significant anymore. To test which specification is correct, I asked STATA to perform a Hausman specification test. Results are shown in Table 6, below.

TABLE 6

Hausman specification test

	---- Coefficients ----		
ltdtd	Fixed Effects	Random Effects	Difference
lnfa	-1.04787	-.1690982	-.8787718
nfata	.2415098	.3244159	-.0829062
nsnfa	.0005287	.0018608	-.001332
pta	-.0263727	.0550803	-.0814529
stab	.0882467	.0457739	.0424728
Iyear_2	.0045472	-.0306504	.0351976
Iyear_3	.0990787	.0321169	.0669618
Iyear_4	.0346901	-.0243033	.0589933
Iyear_5	.0426247	-.0216302	.0642549
Iyear_6	.0619183	-.0041724	.0660907
Iyear_7	.0431131	-.0223345	.0654476

Test: Ho: difference in coefficients not systematic

chi2(11) = (b-B)'[S^(-1)](b-B), S = (S_fe - S_re)
= 96.42
Prob>chi2 = 0.0000

Therefore, the Hausman test permits to reject the null hypothesis that both procedures are providing unbiased estimates of the effect of stabilization on firms' debt maturity (if the null were not rejected, I should have taken the Random Effects estimate, because it gives efficient estimates). Thus, the Two Ways Fixed Effect procedure is the one providing the unbiased estimate of the effect of stabilization on firms' debt maturity and I can conclude that there is a statistically significant effect of permanent inflation stabilization on firms' long-term debt.

4. SOME EXTENSIONS

The results presented in the previous section could be subject to criticism, because I did not intend to control for other macroconomic events that took place in the period under analysis in both countries. Concretely, both economies were subject to processes of financial liberalization (caps on interest rates were removed, controls on credit allocation by the central bank were supressed, etc), experimented a remarkable increase in financial

development, and gained access to both international equity and bond markets. In this section, I make an attempt to control for all these developments, including an index of financial liberalization, an index of financial development, an index of firms' access to bond markets, and an index of firms' access to equity markets in the right hand side of my regressions[8]. Table 7 below presents the new Two Ways Fixed Effect results.

TABLE 7

```
i.year                Iyear_1-7    (naturally coded; Iyear_1 omitted)

Fixed-effects (within) regression               Number of obs      =       513
Group variable (i) : id                         Number of groups   =       113

R-sq:  within  = 0.1678                         Obs per group: min =         1
       between = 0.0673                                        avg =       4.5
       overall = 0.1011                                        max =         7

                                                F(15,385)          =      5.17
corr(u_i, Xb)  = 0.0442                         Prob > F           =    0.0000

------------------------------------------------------------------------------
      ltdtd |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
------------+-----------------------------------------------------------------
       lnfa |   .0141999   .4609235     0.031   0.975    -.8920423    .9204421
      nfata |   .0941142    .116634     0.807   0.420    -.1352051    .3234335
      nsnfa |   .0000713   .0025389     0.028   0.978    -.0049206    .0050632
        pta |  -.0476963    .113903    -0.419   0.676    -.2716462    .1762535
     access |   .0424009   .0364346     1.164   0.245    -.0292348    .1140366
    access2 |   .0306561    .081039     0.378   0.705    -.1286784    .1899906
     findev |   -1.17077   .4301481    -2.722   0.007    -2.016504   -.3250368
        lib |  -.1701748   .1263473    -1.347   0.179    -.4185919    .0782423
       stab |   .2339085   .0620704     3.768   0.000     .111869     .355948
    Iyear_2 |   .0207226   .0263299     0.787   0.432    -.0310458    .072491
    Iyear_3 |   .0742875   .0307168     2.418   0.016     .0138939    .1346811
    Iyear_4 |  -.0690697   .0468355    -1.475   0.141     -.161155    .0230157
    Iyear_5 |  -.0113246   .0363135    -0.312   0.755    -.0827222    .0600729
    Iyear_6 |    .058058   .0410636     1.414   0.158     -.022679    .1387951
    Iyear_7 |   .0477439   .0475193     1.005   0.316    -.0456859    .1411737
      _cons |   .7130929   .1136509     6.274   0.000     .4896389     .936547
------------------------------------------------------------------------------
    sigma_u |  .21317659
    sigma_e |  .14194862
        rho |  .69281471   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(112,385) =     7.71                 Prob > F = 0.0000
```

[8] See the appendix for the definition (and source) of the variables.

As Table 7 shows, once I control for all the macroeconomic developments that took place in both countries during the period of analysis, the effect of permanent stabilization on Argentine firms' (LTD/TD) remains statitically significant and with the correct sign. Certainly it is higher than it was in the previous section.

I present the alternative Random Effect estimate in Table 8 below

TABLE 8

```
i.year                Iyear_1-7    (naturally coded; Iyear_1 omitted)

Random-effects GLS regression                   Number of obs      =       513
Group variable (i) : id                         Number of groups   =       113

R-sq:  within  = 0.1590                         Obs per group: min =         1
       between = 0.1555                                        avg =       4.5
       overall = 0.1668                                        max =         7

Random effects u_i ~ Gaussian                   Wald chi2(15)      =     93.57
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.0000

------------------------------------------------------------------------------
      ltdtd |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
------------+-----------------------------------------------------------------
       lnfa |   .3004086   .1410003     2.131   0.033      .024053    .5767642
      nfata |   .1481419   .0788546     1.879   0.060     -.0064102     .302694
      nsnfa |   .0018935   .0021503     0.881   0.379     -.0023209     .006108
        pta |  -.0797684   .1057305    -0.754   0.451     -.2869964    .1274596
     access |   .0655204   .0358303     1.829   0.067     -.0047056    .1357464
    access2 |   .0450126   .0794119     0.567   0.571     -.1106319     .200657
     findev |  -1.593858   .3903435    -4.083   0.000     -2.358917   -.8287987
        lib |  -.1454301   .0473176    -3.073   0.002     -.2381709   -.0526894
       stab |   .2841456   .0509341     5.579   0.000      .1843165    .3839746
    Iyear_2 |   .0156622   .0264914     0.591   0.554       -.03626    .0675843
    Iyear_3 |   .0589757   .0304891     1.934   0.053     -.0007819    .1187333
    Iyear_4 |  -.1075227   .0350017    -3.072   0.002     -.1761249   -.0389206
    Iyear_5 |  -.0363161   .0291019    -1.248   0.212     -.0933549    .0207226
    Iyear_6 |   .0507361    .037675     1.347   0.178     -.0231055    .1245777
    Iyear_7 |    .046021   .0453717     1.014   0.310     -.0429058    .1349478
      _cons |   .5525831   .1006814     5.488   0.000      .3552512    .7499151
------------+-----------------------------------------------------------------
    sigma_u |  .17681506
    sigma_e |  .14194862
        rho |  .60808706   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

In this specification, stab remains statistically significant and retains the correct sign. To discern which specification is correct, I include the Hauman specification test in Table 9 below.

TABLE 9

Hausman specification test

ltdtd	Coefficients: Fixed Effects	Coefficients: Random Effects	Difference
lnfa	.0141999	.3004086	-.2862087
nfata	.0941142	.1481419	-.0540277
nsnfa	.0000713	.0018935	-.0018222
pta	-.0476963	-.0797684	.0320721
access	.0424009	.0655204	-.0231195
access2	.0306561	.0450126	-.0143565
findev	-1.17077	-1.593858	.4230876
lib	-.1701748	-.1454301	-.0247446
stab	.2339085	.2841456	-.050237
Iyear_2	.0207226	.0156622	.0050604
Iyear_3	.0742875	.0589757	.0153118
Iyear_4	-.0690697	-.1075227	.038453
Iyear_5	-.0113246	-.0363161	.0249915
Iyear_6	.058058	.0507361	.0073219
Iyear_7	.0477439	.046021	.0017229

Test: Ho: difference in coefficients not systematic

chi2(15) = (b-B)'[S^(-1)](b-B), S = (S_fe - S_re)
= 31.94
Prob>chi2 = 0.0066

Again, the Fixed Efect is the correct specification.

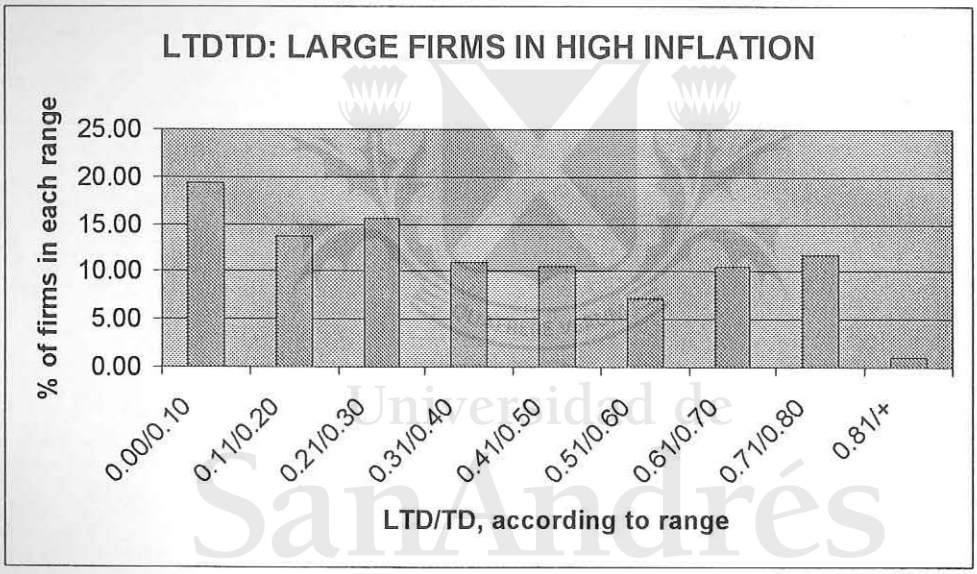
5. SPLITTING THE SAMPLE

In this section, I split the sample in two parts according to the sample median value of different variables (such as size, fraction of physical capital in total assets, rate of profit

over assets, and revenues from sales) to try to infer how is that high inflation (or, more properly, stabilization) affects firms' (LTD/TD)[9].

I start by splitting the sample between large and small firms (large firms being the ones for which the natural logarithm of total assets, as a proxy for size, is larger than the sample median value for that variable). Demirguc-Kunt and Maksimovic (1999) present preliminary cross-country evidence that the effect of inflation is not very different between large and small firms.

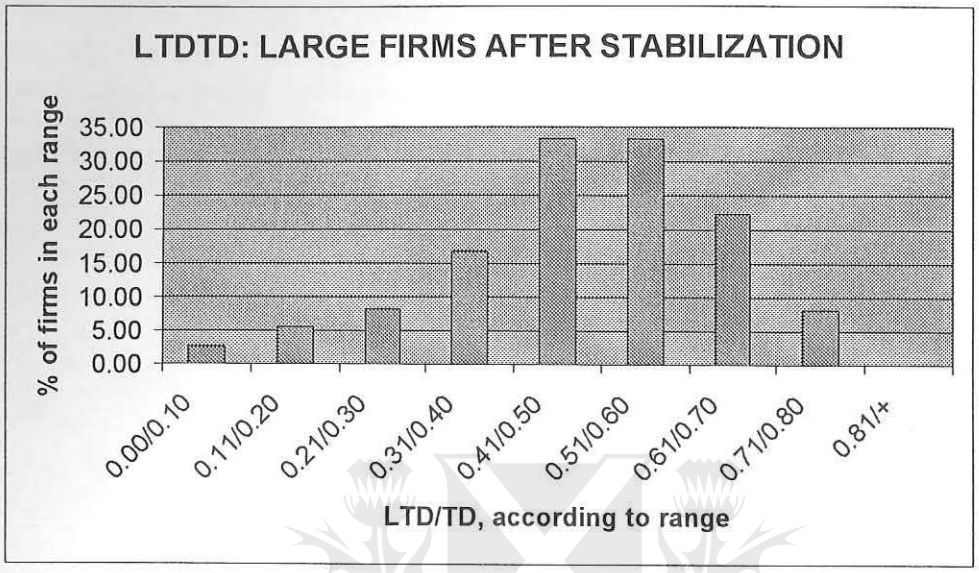
To start with, consider the histograms for the behavior of (LTD/TD) for large firms in high inflation and after stabilization takes place in Argentina. I start with the one corresponding to large firms operating in high inflation.



Notice from the histogram presented above that 1 out of 5 large firms have (LTD/TD) < 10% during high inflation. Moreover, almost 50% (exactly 48.8%) of firms display a ratio (LTD/TD) < 30%, clear evidence in support of the hypothesis that corporate debt tend to be short-term in high inflation environments.

[9] Probably the best way to infer how is that inflation affects firms' debt maturity is by interacting the dummy variable stab with the vector of corporate finance determinants included in the regressions.

Consider now the histogram for large firms operating in low inflation environments (after stabilization occurred):



After stabilization occurred, only 10% of large firms have (LTD/TD) < 10% and the fraction of firms with ratios (LTD/TD) below 30% is only 17%.

Indeed, the regression results show that the effect of inflation on firms' debt maturity is due to the effect that inflation has on *large* firms. Table 10 below shows the Two Ways Fixed Effect estimation procedure applied to large firms[10].

TABLE 10: EFFECTS OF STABILIZATION ON LARGE FIRMS

```
i.year                Iyear_1-7    (naturally coded; Iyear_1 omitted)

Fixed-effects (within) regression               Number of obs      =       260
Group variable (i) : id                         Number of groups   =        58
```

However, as a first step, I decided to split the sample in this discrete, two dimensional way to get some intuition as of what was going on.

[10] The Random Effects estimation and the Hausman test (chi2 = 48.18) are not reported for space considerations, but are available upon request from the author. Anyways, according to the Hausman test, the Fixed Effect is the correct specification in the present case.

```
R-sq:  within  = 0.3200                         Obs per group: min =         1
       between = 0.0456                                        avg =       4.5
       overall = 0.0014                                        max =         7

                                                F(15,187)           =      5.87
corr(u_i, Xb)  = -0.7716                        Prob > F            =    0.0000

------------------------------------------------------------------------------
      ltdtd |      Coef.   Std. Err.       t     P>|t|       [95% Conf. Interval]
------------+-----------------------------------------------------------------
       lnfa |    .8983104   .5806382     1.547   0.124      -.2471327    2.043753
      nfata |   -.3415427   .1864293    -1.832   0.069      -.7093176    .0262321
      nsnfa |   -.0000727   .0233805    -0.003   0.998      -.0461962    .0460508
        pta |   -.3861706   .2247795    -1.718   0.087      -.8296001    .0572589
     access |   -.0049633    .051998    -0.095   0.924      -.1075413    .0976147
    access2 |   -.0894445   .1143214    -0.782   0.435      -.3149698    .1360808
     findev |   -.9183345   .5799096    -1.584   0.115       -2.06234     .225671
        lib |   -.6072963   .2158572    -2.813   0.005      -1.033124   -.1814681
       stab |     .257595   .0981641     2.624   0.009       .0639437    .4512463
    Iyear_2 |    .0074857   .0297569     0.252   0.802      -.0512166    .0661879
    Iyear_3 |    .0132157   .0363357     0.364   0.716      -.0584649    .0848962
    Iyear_4 |   -.1339382   .0547477    -2.446   0.015      -.2419406   -.0259358
    Iyear_5 |   -.0774358   .0434061    -1.784   0.076      -.1630644    .0081929
    Iyear_6 |    -.000096   .0803946    -0.001   0.999      -.1586929    .1585009
    Iyear_7 |   -.0031782   .0918702    -0.035   0.972      -.1844134    .1780571
      _cons |    1.041552   .1804018     5.774   0.000       .6856673    1.397436
------------------------------------------------------------------------------
    sigma_u |  .38473655
    sigma_e |  .13710878
        rho |  .88731147   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(57,187) =     6.05                 Prob > F = 0.0000
```

Instead, when the effect of inflation stabilization on small firms is considered, the results are not so neat: the coefficient on stab is very large, displays the correct sign, but it is not statistically significant. Table 11 reports the results.

TABLE 11: EFFECTS OF STABILIZATION ON SMALL FIRMS

```
Fixed-effects (within) regression               Number of obs      =       253
Group variable (i) : id                         Number of groups   =        67

R-sq:  within  = 0.0903                         Obs per group: min =         1
       between = 0.0996                                        avg =       3.8
       overall = 0.0056                                        max =         7

                                                F(14,172)           =      1.22
corr(u_i, Xb)  = -0.3746                        Prob > F            =    0.2648

------------------------------------------------------------------------------
      ltdtd |      Coef.   Std. Err.       t     P>|t|       [95% Conf. Interval]
------------+-----------------------------------------------------------------
       lnfa |   -.343781   1.108531    -0.310   0.757      -2.531856    1.844294
```

```
   nfata |   .2792556    .167318      1.669   0.097      -.0510053    .6095165
   nsnfa |  -.0006012   .0026871     -0.224   0.823      -.0059051    .0047026
     pta |   .1112451   .1331972      0.835   0.405      -.1516665    .3741567
  access |   .0430723   .0602974      0.714   0.476      -.0759459    .1620904
 access2 |   .2160269   .1591726      1.357   0.177      -.0981563    .5302101
  findev | -3.7954670  7.133732     -0.532   0.595       -17.8764    10.28546
     lib |   .0630832   .7398072      0.085   0.932      -1.397187    1.523353
    stab |   .6507176  1.3619999      0.478   0.633      -2.037668    3.339103
 Iyear_2 |  -.0074122   .2301837     -0.032   0.974      -.4617607    .4469363
 Iyear_3 |   .0824923   .2944216      0.280   0.780      -.4986524    .6636371
 Iyear_4 |   .2879072   .6255642      0.460   0.646       -.946864    1.522678
 Iyear_5 |   .5359671   1.043803      0.513   0.608      -1.524345    2.596279
 Iyear_6 |   .6756174   1.307618      0.517   0.606      -1.905428    3.256663
 Iyear_7 |   .6507216   1.361999      0.478   0.633      -2.037663    3.339107
   _cons |   .6844093   2.302178      0.297   0.767      -3.859749    5.228567
------------------------------------------------------------------------------
 sigma_u |  .23587782
 sigma_e |  .13833427
     rho |  .74407966   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(66,172) =     6.15                 Prob > F = 0.0000
```

When I splitted the sample according to the sample median value of the ratio of tangible assets to total assets (a proxy for the stock of physical capital), I found that the effects of inflation stabilization were not very different for firms holding a relatively high fraction of human capital in the production process than for firms using a relatively low fraction of human capital in production. Tables 12 and 13 below report those results[11].

TABLE 12: EFFECTS OF STABILIZATION ON FIRMS WITH A LOW NFATA

```
i.year                Iyear_1-7    (naturally coded; Iyear_1 omitted)

Fixed-effects (within) regression               Number of obs      =       269
Group variable (i) : id                         Number of groups   =        80

R-sq:  within  = 0.2144                         Obs per group: min =         1
       between = 0.0456                                        avg =       3.4
       overall = 0.0023                                        max =         7

                                                F(15,174)          =      3.17
corr(u_i, Xb)  = -0.8653                        Prob > F           =    0.0001
```

[11] Again, the Random Effects specifications and the Hausman tests will not be included for space considerations, but are available upon request from the author. In both cases, the Fixed Effect spcification turned out to be the correct one, anyways.

```
------------------------------------------------------------------------------
      ltdtd |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
------------+-----------------------------------------------------------------
       lnfa |  -1.603625   .8265242    -1.940   0.054    -3.234929    .0276785
      nfata |   .1717093   .1905661     0.901   0.369    -.2044093    .5478279
      nsnfa |  -.0047122   .0037508    -1.256   0.211    -.0121152    .0026907
        pta |  -.1526772   .1299051    -1.175   0.241    -.4090699    .1037154
     access |   .0424737   .0504881     0.841   0.401    -.0571741    .1421216
    access2 |   .8498416   .5064701     1.678   0.095     -.149774    1.849457
     findev |  -.9784336   .6906118    -1.417   0.158    -2.341488    .3846211
        lib |   .3143389   .1941894     1.619   0.107    -.0689311    .6976088
       stab |   .1803008    .095522     1.888   0.061    -.0082302    .3688318
    Iyear_2 |   .0485532   .0423352     1.147   0.253    -.0350035    .1321099
    Iyear_3 |   .0908793   .0513599     1.769   0.079    -.0104893    .1922479
    Iyear_4 |   .0008823   .0815998     0.011   0.991    -.1601705    .1619352
    Iyear_5 |   .0911543    .060924     1.496   0.136    -.0290909    .2113994
    Iyear_6 |   .1342845   .0610076     2.201   0.029     .0138744    .2546947
    Iyear_7 |   .0821962   .0680105     1.209   0.228    -.0520355    .2164278
      _cons |   .5195018    .170127     3.054   0.003     .1837236    .8552801
------------------------------------------------------------------------------
    sigma_u |    .472248
    sigma_e |  .12902672
        rho |  .93053712   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(79,174) =     6.78                 Prob > F = 0.0000
```

Notice that stab is not significant at the 5% conventional level to explain how inflation stabilization affects the debt maturity of firms holding a low fraction of physical capital to produce output. However, it is marginally significant at the 6% level, and the sign is positive, as expected.

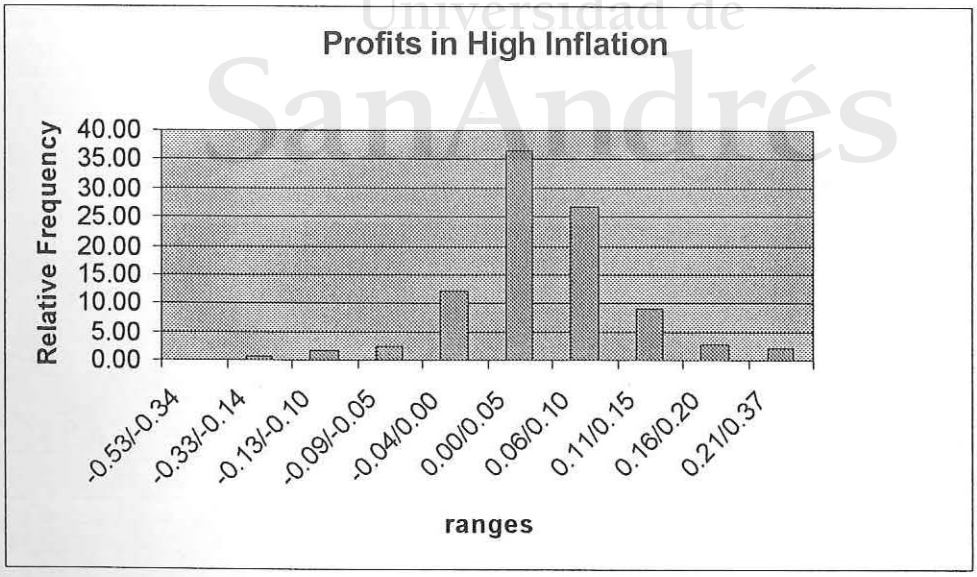
TABLE 13: EFFECTS OF STABILIZATION ON FIRMS WITH A HIGH NFATA

```
i.year                Iyear_1-7    (naturally coded; Iyear_1 omitted)

Fixed-effects (within) regression               Number of obs      =       244
Group variable (i) : id                         Number of groups   =        69

R-sq:  within  = 0.2559                         Obs per group: min =         1
       between = 0.0806                                        avg =       3.5
       overall = 0.1080                                        max =         7

                                                F(15,160)          =      3.67
corr(u_i, Xb)  = -0.5110                        Prob > F           =    0.0000

------------------------------------------------------------------------------
      ltdtd |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
------------+-----------------------------------------------------------------
       lnfa |    .428081   .6275344     0.682   0.496    -.8112376     1.6674
      nfata |  -.2267613   .2580003    -0.879   0.381    -.7362864    .2827639
      nsnfa |  -.0952037   .0502619    -1.894   0.060     -.194466    .0040586
```

```
       pta |   -.008797   .2781564    -0.032   0.975    -.5581284    .5405344
    access |   .0468578   .0515507     0.909   0.365    -.0549497    .1486653
   access2 |  -.1052252   .0946413    -1.112   0.268    -.2921325    .0816821
    findev |  -.9961849   .5894228    -1.690   0.093    -2.160237     .167867
       lib |  -.3417862   .1906134    -1.793   0.075    -.7182289    .0346566
      stab |    .175124   .0891296     1.965   0.051    -.0008981    .3511462
   Iyear_2 |  -.0098285   .0339385    -0.290   0.773    -.0768537    .0571968
   Iyear_3 |    .010998   .0420601     0.261   0.794    -.0720665    .0940624
   Iyear_4 |  -.1235426   .0615621    -2.007   0.046    -.2451217   -.0019634
   Iyear_5 |  -.0804026   .0471584    -1.705   0.090    -.1735359    .0127306
   Iyear_6 |   .0049588   .0611402     0.081   0.935    -.1157871    .1257046
   Iyear_7 |   .0554817   .0745647     0.744   0.458    -.0917763    .2027396
     _cons |   1.111957   .2375821     4.680   0.000     .6427558    1.581158
-------------------------------------------------------------------------------
   sigma_u |  .24707044
   sigma_e |  .13808834
       rho |  .76197892   (fraction of variance due to u_i)
-------------------------------------------------------------------------------
F test that all u_i=0:     F(68,160) =     5.39                 Prob > F = 0.0000
```

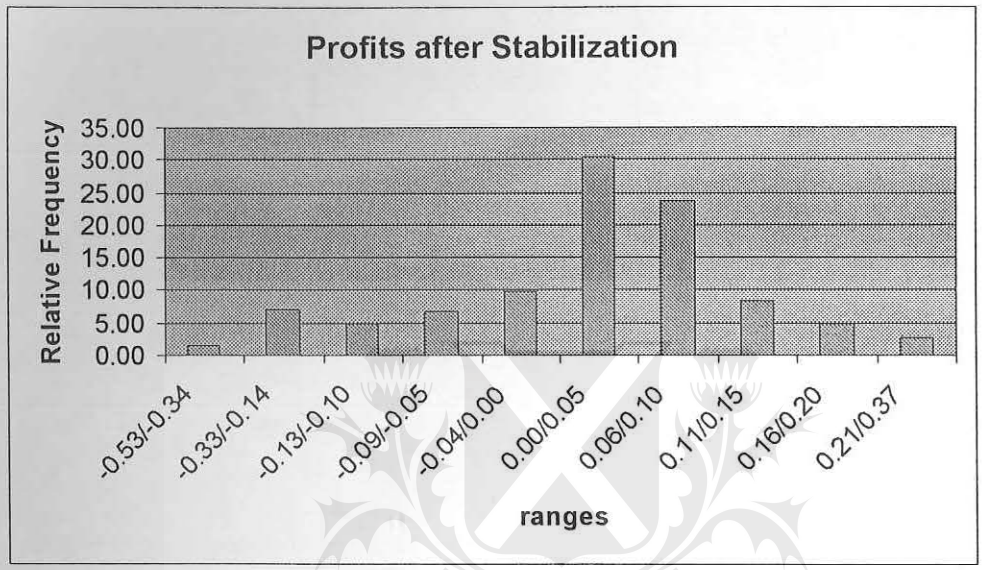
Notice that the coefficient on stab is very similar than the one reported in Table 12. The only (very slight) difference is that now stab is marginally significant at the 5% level.

The next step was to split the sample according to the sample median value of the rate of profit over assets. Before presenting the regression results, it pays to take a glance at the histograms for profits in high inflation and after stabilization takes place.



Notice from the chart presented above that less than 5 % of firms (actually 4.87 %) have a rate of profit over assets that is less than 5 % in a high inflation environment.

When we take a glance at the histogram for profits in a stable environment, the picture changes completely:



Now, exactly 20 % of firms have a rate of profit below 5 %. This evidence is consistent with the finding that the number of bankruptcies increased dramatically after the 1985 israeli stabilization (reported by Bruno and Meridar, 1991). The previous finding is consistent with the hypothesis, first formulated in an analytical model by Tommasi (1994), that resources are poorly allocated in a high inflation regime and the low rates of profit (or even bankruptcies) are the result to be expected after inflation is stabilized. Both histograms suggest what to expect from the regression results: the effects of inflation stabilization should be stronger for firms with high profits (i.e. the ones that were probably not able to get long-term financing in a high inflation environment, even when their solvency was not in question, but the ones that will be able to get it when inflation is stabilized). Tables 14 and 15 below show exactly this result.

TABLE 14: EFFECTS OF STABILIZATION ON FIRMS WITH LOW PROFITS

```
i.year                    Iyear_1-7    (naturally coded; Iyear_1 omitted)
```

```
Fixed-effects (within) regression               Number of obs      =       268
Group variable (i) : id                         Number of groups   =        94

R-sq:  within  = 0.2411                         Obs per group: min =         1
       between = 0.0390                                        avg =       2.9
       overall = 0.0934                                        max =         7

                                                F(15,159)          =      3.37
corr(u_i, Xb)  = -0.1831                        Prob > F           =    0.0001

------------------------------------------------------------------------------
      ltdtd |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
------------+-----------------------------------------------------------------
       lnfa |   -.301418    .808601    -0.373   0.710    -1.898402    1.295566
      nfata |   .2578932   .2008629     1.284   0.201    -.1388103    .6545967
      nsnfa |  -.0147181   .0229265    -0.642   0.522    -.0599978    .0305616
        pta |   .4929788   .2010084     2.453   0.015     .0959879    .8899696
     access |  -.0406882    .069587    -0.585   0.560    -.1781223     .096746
    access2 |    .289075   .2233083     1.295   0.197    -.1519579     .730108
     findev |   .2454484   .7028875     0.349   0.727    -1.142752    1.633649
        lib |  -.2963764   .2193039    -1.351   0.178    -.7295008    .1367479
       stab |   .0713481   .1101344     0.648   0.518     -.146167    .2888632
    Iyear_2 |  -.0302089   .0399335    -0.756   0.450    -.1090775    .0486597
    Iyear_3 |   .1215368    .048386     2.512   0.013     .0259748    .2170989
    Iyear_4 |   .0334094    .088876     0.376   0.707    -.1421204    .2089391
    Iyear_5 |   .0450038   .0682999     0.659   0.511    -.0898883    .1798959
    Iyear_6 |   .0589805   .0702002     0.840   0.402    -.0796646    .1976257
    Iyear_7 |  -.0262777   .0856418    -0.307   0.759     -.19542    .1428645
      _cons |   .8589739    .187879     4.572   0.000     .4879136    1.230034
------------+-----------------------------------------------------------------
    sigma_u |  .23937165
    sigma_e |  .14181395
        rho |  .74019891   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(93,159) =     6.04                 Prob > F = 0.0000
```

As Table 14 shows, it seems that stabilization does not affect the ratio LTD/TD for firms with low profits.

However, this is not the case for firms with higher than saple median profits, as Table 15 makes clear.

TABLE 15 : EFFECTS OF STABILIZATION ON FIRMS WITH HIGH PROFITS

```
i.year                    Iyear_1-7    (naturally coded; Iyear_1 omitted)

Fixed-effects (within) regression               Number of obs      =       245
```

```
Group variable (i) : id                         Number of groups   =        83

R-sq:  within  = 0.2419                         Obs per group: min =         1
       between = 0.0445                                        avg =       3.0
       overall = 0.1306                                        max =         6

                                                F(15,147)          =      3.13
corr(u_i, Xb)  = -0.0021                        Prob > F           =    0.0002

------------------------------------------------------------------------------
      ltdtd |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
------------+-----------------------------------------------------------------
       lnfa |   .1677803   .6749875     0.249   0.804    -1.166152    1.501713
      nfata |    .019904   .1964518     0.101   0.919    -.3683307    .4081386
      nsnfa |   .0039472    .005937     0.665   0.507    -.0077857    .0156801
        pta |  -.6513988   .2524923    -2.580   0.011    -1.150383   -.1524151
     access |   .0665793   .0460049     1.447   0.150     -.024337    .1574956
    access2 |  -.0748324    .094514    -0.792   0.430    -.2616142    .1119494
     findev |  -1.954954   .6582229    -2.970   0.003    -3.255756   -.6541523
        lib |   -.139303   .1829906    -0.761   0.448    -.5009351    .2223291
       stab |   .2969647   .0921133     3.224   0.002     .1149274    .4790021
    Iyear_2 |  -.0060694   .0403193    -0.151   0.881    -.0857498     .073611
    Iyear_3 |   .0259791   .0452008     0.575   0.566    -.0633483    .1153065
    Iyear_4 |  -.0958691   .0656774    -1.460   0.147    -.2256631    .0339248
    Iyear_5 |  -.0272218   .0503167    -0.541   0.589    -.1266593    .0722157
    Iyear_6 |   .0884753   .0604654     1.463   0.146    -.0310184     .207969
    Iyear_7 |   .1027673   .0661559     1.553   0.122    -.0279722    .2335069
      _cons |   .7665737   .1768365     4.335   0.000     .4171034    1.116044
------------------------------------------------------------------------------
    sigma_u |  .22742946
    sigma_e |   .1345209
        rho |   .7408212   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(82,147) =     4.85                 Prob > F = 0.0000
```

At this point, an additional question arises: the effect summarized in Tables 14 and 15 is originated in firms' revenues, or in firms' costs? The answer to this question is important because the existing models that help to rationalize the effects of inflation (of the Tommasi, 1994 search-theoretic variety) are based on costs considerations. Since profits are equal to revenues minus costs, even with no data for firms' costs (as it is the present case), if I find no impact of inflation stabilization for either firms with small revenues from sales, or for firms with high revenues from sales, I will be able to infer that the effects of inflation stabilization operate through firms' costs. This is exactly what Tables 16 and 17 below seem to be showing.

TABLE 16: EFFECTS OF STABILIZATION ON FIRMS WITH LOW REVENUES

```
i.year                Iyear_1-7    (naturally coded; Iyear_1 omitted)

Fixed-effects (within) regression               Number of obs      =       261
Group variable (i) : id                         Number of groups   =        72

R-sq:  within  = 0.2208                         Obs per group: min =         1
       between = 0.0014                                        avg =       3.6
       overall = 0.0121                                        max =         7

                                                F(15,174)          =      3.29
corr(u_i, Xb)  = -0.4175                        Prob > F           =    0.0001

------------------------------------------------------------------------------
      ltdtd |      Coef.   Std. Err.       t     P>|t|       [95% Conf. Interval]
------------+-----------------------------------------------------------------
       lnfa |   -.375028   .6173146     -0.608   0.544      -1.593416    .8433605
      nfata |  -.0550838   .1817085     -0.303   0.762      -.4137203    .3035526
      nsnfa |  -.1910822   .0627509     -3.045   0.003      -.3149331   -.0672312
        pta |   .4383477   .2115801      2.072   0.040       .020754    .8559415
     access |   .0503716   .0463459      1.087   0.279      -.0411009     .141844
    access2 |  -.1358026   .1065974     -1.274   0.204      -.3461929    .0745877
     findev |   -1.31887    .613914     -2.148   0.033      -2.530547   -.1071934
        lib |   .0863838   .1834122      0.471   0.638      -.2756153    .4483828
       stab |   .1383679   .0904501      1.530   0.128      -.0401527    .3168886
    Iyear_2 |  -.0119647   .0360405     -0.332   0.740      -.0830975    .0591681
    Iyear_3 |  -.0043185   .0417193     -0.104   0.918      -.0866594    .0780225
    Iyear_4 |  -.1124588   .0614225     -1.831   0.069      -.2336879    .0087703
    Iyear_5 |  -.0314939   .0490076     -0.643   0.521      -.1282197    .0652319
    Iyear_6 |   .0593208   .0584843      1.014   0.312      -.0561092    .1747508
    Iyear_7 |   .0930283   .0696827      1.335   0.184      -.0445038    .2305604
      _cons |   .9308774   .1746046      5.331   0.000       .5862618    1.275493
------------------------------------------------------------------------------
    sigma_u |  .24257079
    sigma_e |  .14155039
        rho |  .74597806   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(71,174) =     6.06                 Prob > F = 0.0000
```

No statistically significant (at the 5 % level) effect of stabilization occurs on firms with lower than median revenues from sales.

TABLE 17: EFFECTS OF STABILIZATION ON FIRMS WITH HIGH REVENUES

```
i.year                Iyear_1-7    (naturally coded; Iyear_1 omitted)

Fixed-effects (within) regression               Number of obs      =       252
Group variable (i) : id                         Number of groups   =        72

R-sq:  within  = 0.1738                         Obs per group: min =         1
       between = 0.0169                                        avg =       3.5
```

```
       overall = 0.0000                                max =         7

                                               F(15,165)           =      2.31
corr(u_i, Xb)  = -0.8002                       Prob > F            =    0.0051

------------------------------------------------------------------------------
      ltdtd |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
------------+-----------------------------------------------------------------
       lnfa |  -.9936359   .7022687    -1.415   0.159    -2.380227    .3929554
      nfata |   .1694896   .1447047     1.171   0.243     -.116222    .4552012
      nsnfa |  -.0031034   .0031999    -0.970   0.334    -.0094214    .0032145
        pta |  -.0678502   .1232483    -0.551   0.583    -.3111972    .1754968
     access |   .0543306   .0520695     1.043   0.298    -.0484779    .1571391
    access2 |   .6632692   .4362504     1.520   0.130    -.1980835    1.524622
     findev |  -.4822439   .5223587    -0.923   0.357    -1.513613    .5491249
        lib |   .1421082   .1830969     0.776   0.439    -.2194066     .503623
       stab |   .1041638   .0814146     1.279   0.203     -.056585    .2649126
    Iyear_2 |   .0403091   .0314152     1.283   0.201    -.0217184    .1023366
    Iyear_3 |   .0843435   .0431981     1.952   0.053    -.0009487    .1696358
    Iyear_4 |   .0547457   .0667593     0.820   0.413     -.077067    .1865584
    Iyear_5 |    .084024   .0492188     1.707   0.090    -.0131559    .1812039
    Iyear_6 |   .1169825   .0508329     2.301   0.023     .0166158    .2173492
    Iyear_7 |   .0428843   .0574907     0.746   0.457     -.070628    .1563966
      _cons |   .4072395   .1438357     2.831   0.005     .1232438    .6912353
------------------------------------------------------------------------------
    sigma_u |  .30998127
    sigma_e |  .10937338
        rho |  .88928797   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(71,165) =     6.06                 Prob > F = 0.0000
```

Again, there is no statistically significant (at the 5 % level) effect of stabilization on the ratio LTD/TD for firms with higher than sample median values for revenues from sales.

6. SUMMARY OF RESULTS AND CONCLUDING REMARKS

The main results can be summarized as follows. First, there is a clear positive effect of a permanent stabilization on the lenghthening of Argentine firms' debt, after controlling for both a vector of standard corporate finance determinants and a set of macroeconomic developments that took place more or less simultaneously with the stabilization of inflation. Second, the stabilization of inflation seems to have affected particularly large firms and high profits/low cost firms' (LTD/TD) in Argentina.

A rather natural question may arise at this point: why is the shortening of debt maturity under high inflation conditions (or its reciprocal, the lenghthening of debt maturity after permanent inflation stabilization takes place) a relevant issue?

First, the shortening of the term structure of nominal contracts in high inflation conditions has been a major financial development in economies displaying high rates of inflation during the 1980s. In fact, the issue is receiving attention in the monetary economics literature[12] . Second, the issue is potentially relevant for economic growth. Recent studies in this area (Barro, 1995, 1997; De Gregorio 1992, 1993) found, using *aggregate data* for a cross-section of countries, that investment is the main link between inflation and growth (i.e. inflation reduces investment and, hence, growth is adversely affected). Endogeneity is a big problem, however. Using firm level data can help to deal with the endogeneity problem (it is difficult to make the point that the rate of inflation is affected at the firm level). If one finds support for the idea that inflation shortens the maturity structure of nominal contracts, then a second natural step would be to investigate how investment is affected. The hypothesis is that both the level and the efficiency of investment are decreased by high inflation. This constitutes the second part of my PhD dissertation agenda. Finally, recent studies in the area of applied corporate finance (Schmukler and Vesperoni, 2000, for instance) have found that a measure of financial liberalization tends to shorten the maturity structure of firms' corporate debt, in a subset of emerging economies. They did not control for inflation stabilization, however. Therefore, applying the same methodology used in this paper to their data set, I will be able to test the robustness of their finding to the inclusion of inflation stabilization considerations.

[12] See the recent paper by Neumeyer in the Journal of Economic Dynamics and Control (1999), for instance.

APPENDIX: Definition of Variables in the DATA SET

All the corporate data is taken from the IFC (World Bank) database, or the Worldscope database.

LTD/TD: Ratio of debt obligations due more than one year and total liabilities.

LNFA: Natural logarithm of Net Fixed Assets.

NFATA: Ratio of Net Fixed Assets and Total Assets.

NSNFA: Ratio of Net Sales and Net Fixed Assets

PTA: Ratio of firms' Profits and Total Assets.

I have borrowed all the "macro" data from Sergio Schmukler, at The World Bank.

FINDEV: Average of an index of Market Capitalization and an index of the degree of monetization of the economy. The index of Financial Development was constructed by A. Demirguc-Kunt, Research Department, The World Bank, Washington, D.C. The index is used in Schmukler and Vesperoni (2000).

ACCESS: Index of the access of firms to international Bonds markets. Constructed by Schmukler and Vesperoni (Research Department, The World Bank, Washington, D.C.). The index is used in Schmukler and Vesperoni (2000).

ACCESS2: Index of the access of firms to international equity markets. Constructed by Schmukler and Vesperoni (Research Department, The World Bank, Washington, D.C.). The index is used in Schmukler and Vesperoni (2000).

LIB: Multidimensional index of Financial Liberalization. It is a weighted average of measures of interest rates (both credit and deposit rates) liberalization, credit control deregulation, reserve requirements liberalization on bank deposits, liberalization on restrictions on deposits in foreign currency in the domestic financial system and liberalization on borrowing abroad restrictions both by corporations and commercial banks.

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