NAFTA at 20

EFFECTS ON THE NORTH AMERICAN MARKET

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SESSION 2

FOREIGN DIRECT INVESTMENT AND ECONOMIC GROWTH IN MEXICO: 1940-2013

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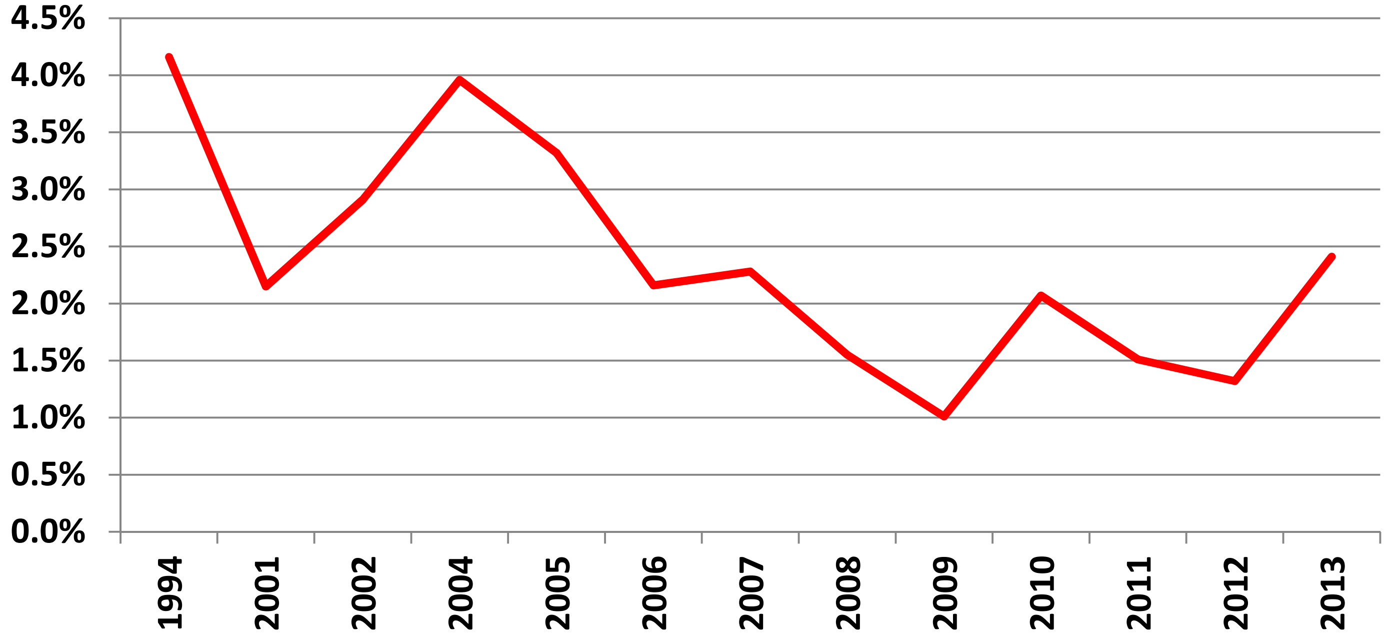
For Mexico, One of the mayor Objectives of NAFTA was to attract FDI

FDI IN MEXICO AS % WORLD TOTAL



Source: UNCTAD, CEPAL and SE

This paper studies the impact of direct foreign investment (FDI) on productivity for the period 1940-2013. We use an aggregate production function that relates aggregate production with labor, and capital of three types: private domestic, foreign and government. We divide the study in two periods.

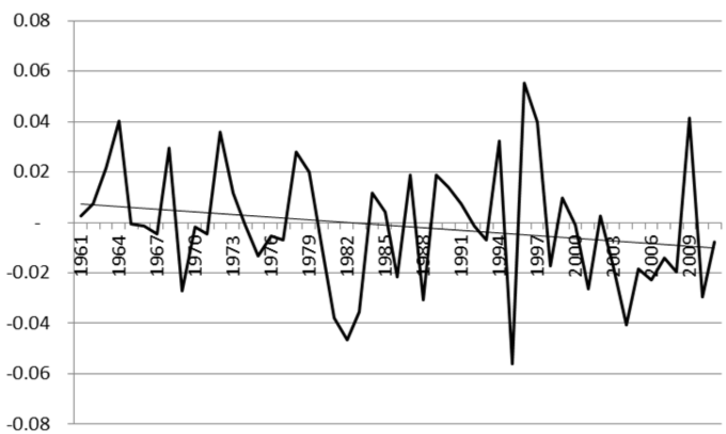
In the first period we find that the impact of foreign capital on productivity is important and greater than the effect of private domestic capital. In the second period growth is led by private domestic capital and foreign capital has a positive but minor effect on growth.

TFP AND THE GROWTH IN LABOR PRODUCTIVITY 1960-2013

A

TOTAL FACTOR PRODUCTIVITY

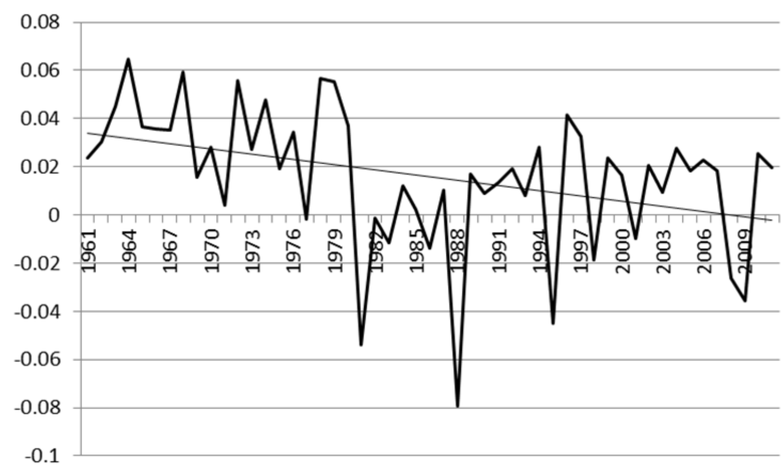
$TFP = g_Y - [\alpha g_K + (1-\alpha) g_L]$



B

LABOR PRODUCTIVTY, GROWTH RATE

$LP = g_Y - g_L$



Source: INEGI (Sistema de Cuentas Nacionales) and author's own calculations.

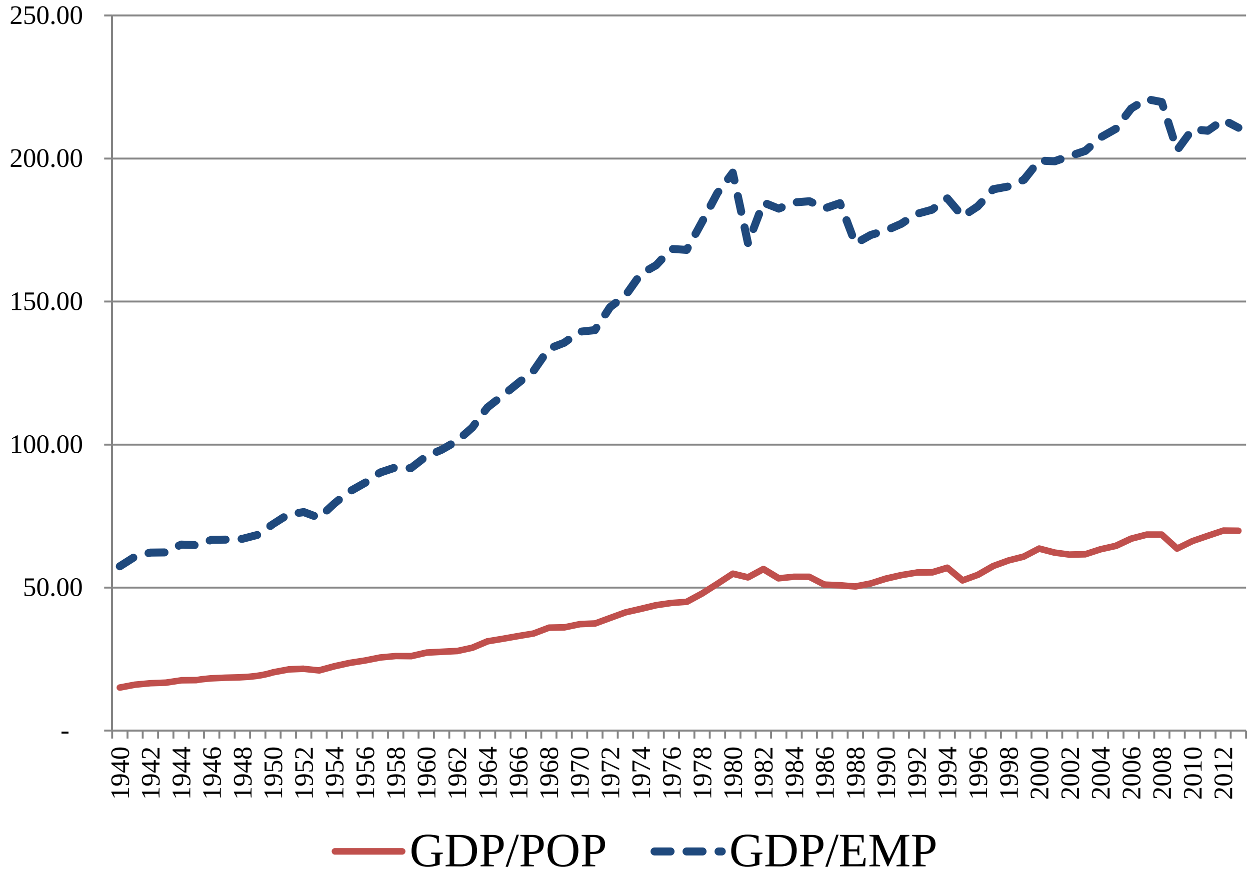
Even TFP =0, we can have LP growth rate > 0. This is typical in developing countries

$$\frac{GDP}{POP} \equiv \frac{GDP}{EMP}\frac{LAB}{POP}\frac{EMP}{LAB}$$

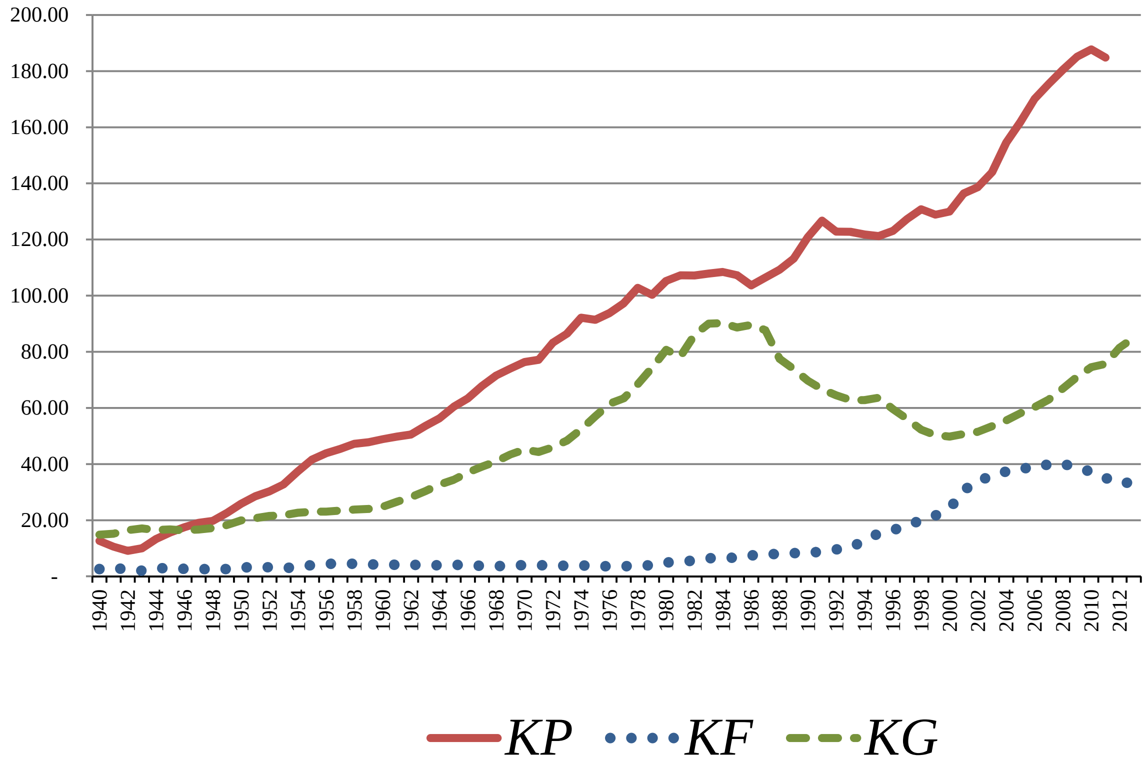
$$EMP \simeq LAB$$

$$\frac{GDP}{POB} \cong \frac{GDP}{LAB}\frac{LAB}{POB}$$

GDP PER CAPITA AND GDP PER WORKER: 1940-2013
(Thousands of pesos of 2003)

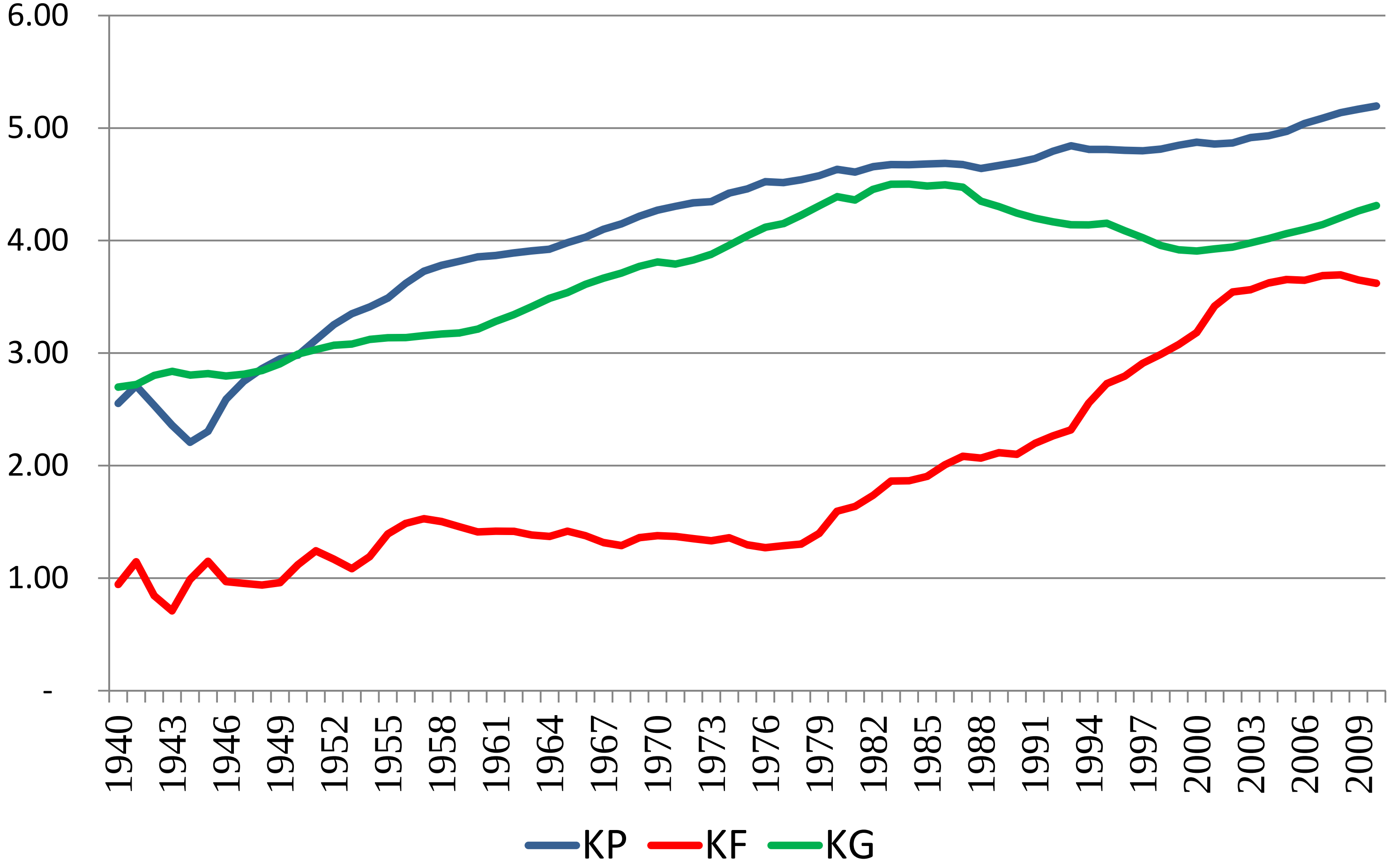


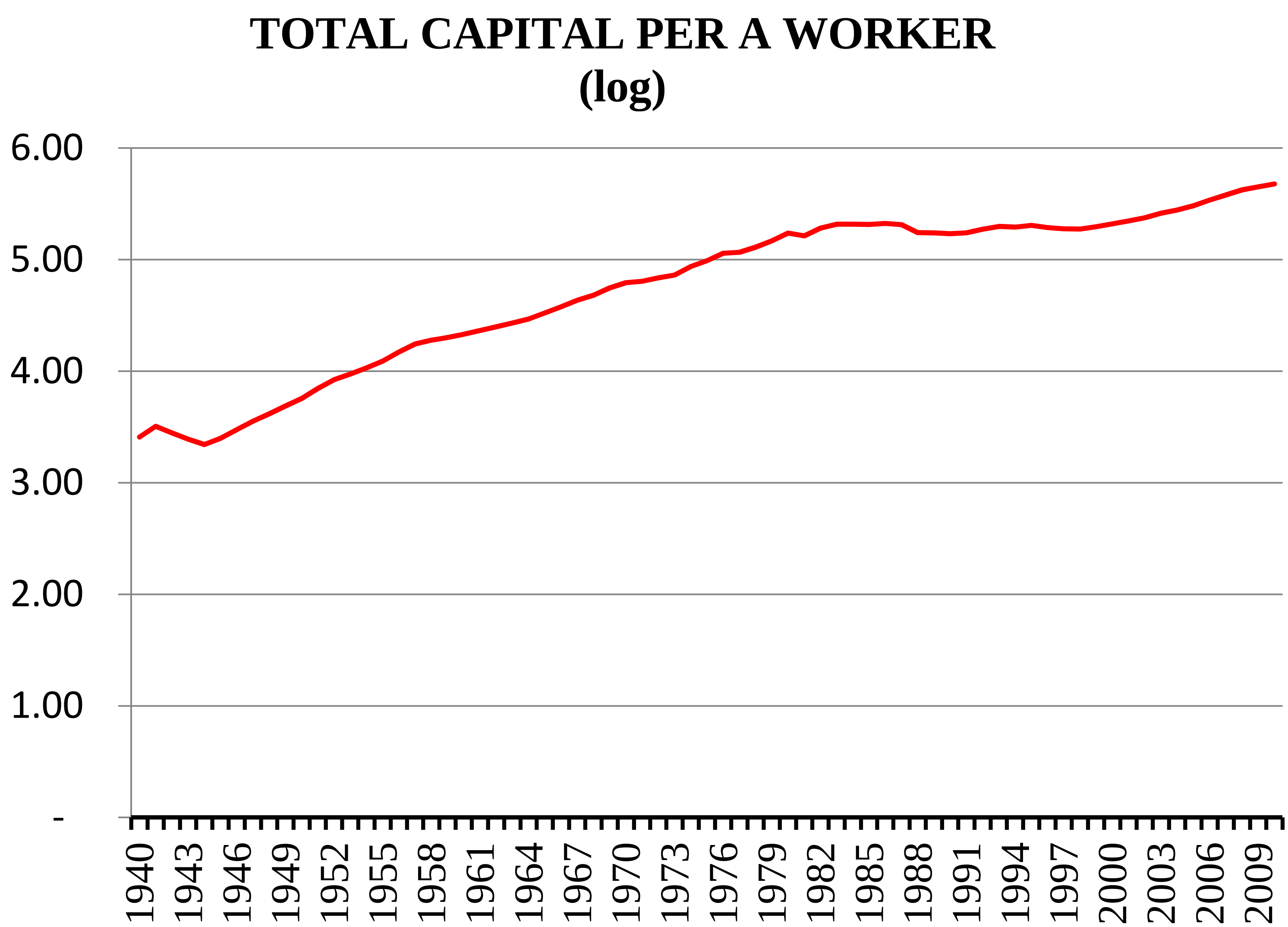
CAPITAL PER WORKER, 1941-2013
(Thousands of pesos of 2003)



KP: Domestic private capital per worker, KF Foreign capital per worker and KG: government capital per worker.
Source: Author's own calculations using the Perpetual Inventory Method and data from Nacional Financiera, *La Economía Mexicana en Cifras* (1978); INEGI, *Estadísticas Históricas de México* (1999); Presidencia de la República, government report, multiple years. See appendix

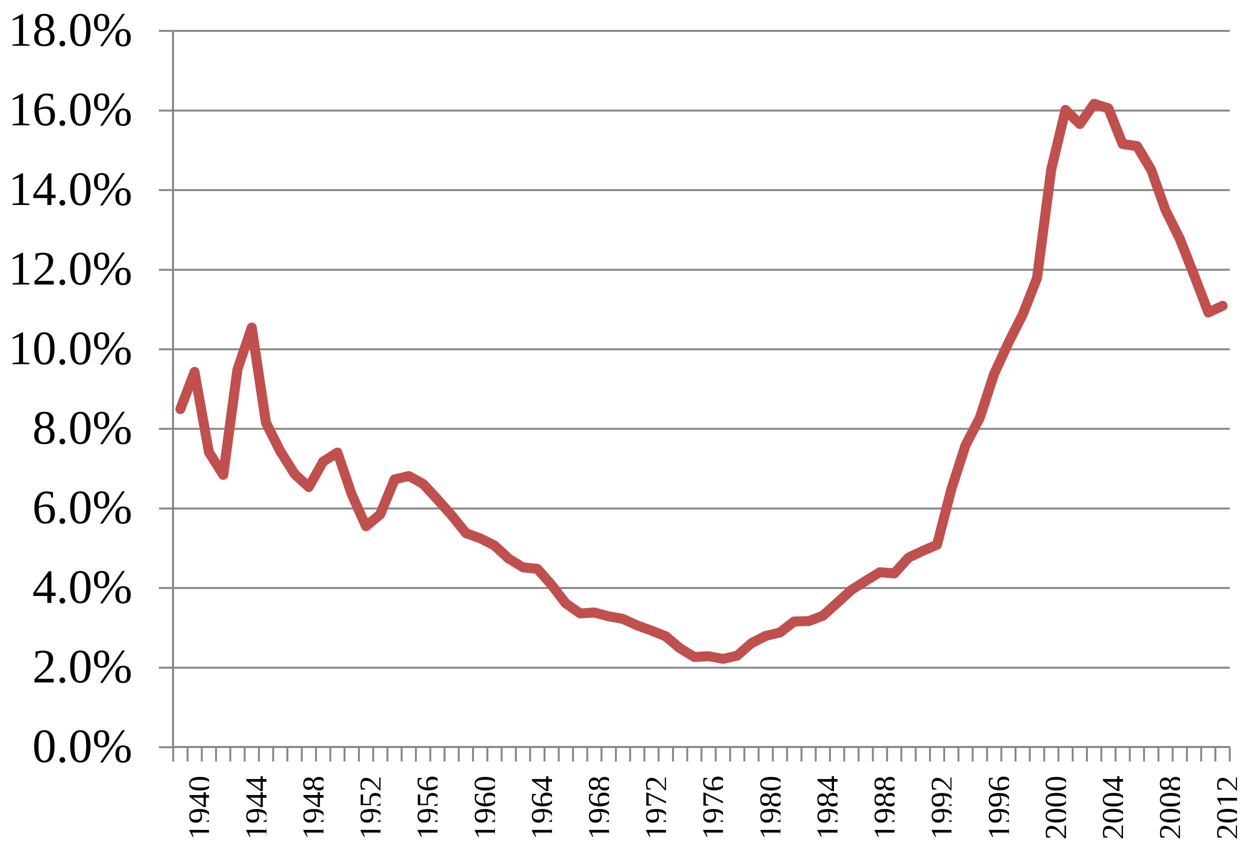
CAPITAL PER WORKER, 1941-2013
(logs)





TOTAL CAPITAL PER A WORKER
(log)
6.00
5.00
4.00
3.00
2.00
1.00
-
1940
1943
1946
1949
1952
1955
1958
1961
1964
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006
2009

FOREIGN CAPITAL AS A PERCENTAGE OF TOTAL CAPITAL



$$Y = AL^a K_p^b K_f^c K_g^d$$

Taking logs:

$$y = ln(A) + al + \ bk_p + ck_f + dk_g$$

Taking differences we obtain growth rates:

$$g_Y = g_A + ag_l \ + bg_{k_p} \ + \ cg_{K_f} + dg_{K_g}$$

Finally, to obtain an expression for the growth of labor productivity, we subtract the expression g_l from each side of the equation

$$g_Y - g_l = g_A + (a-1)g_l \ + bg_{K_p} \ + cg_{K_f} + dg_{K_g}$$

THE EMPIRICAL MODEL

$$\Delta y_t - \Delta l_t = \beta_0 + \beta_1 \Delta l_t + \beta_2 \Delta k_{p,t} + \beta_3 \Delta k_{f,t} + \beta_4 \Delta k_{g,t} + \beta_5 \Delta rer_t + \varepsilon_t$$

Control variable: $\Delta rer_t = ln(RER_t) - ln(RER_{t-1})]$

PHILLIPS-PERRON (PP) TEST: LEVELS

Variables	**Intercept**	**With Intercept and Trend**	**Without Trend and Intercept**
$ln\ (Y/L)_t$	-2.8281	-0.3812	4.2545
$ln(L)$	-2.6798	-1.2531	9.3111
$ln(K_p)$	-2.1778	-1.1220	5.2385
$ln(K_f)$	0.2736	-1.5421	4.9579
$ln(K_g)$	-1.6429	-1.1934	4.1080
$ln(RER)$	-2.8337	-3.2391	-1.7181

Note: the critical values of the PP test with intercept, with trend and intercept and without trend or intercept at significance levels of 1%, 5% and 10% are respectively: -3.5229, -2.9018, -2.5883; -4.0887, -3.4726, -3.1635; -2.5970, -1.9453, -1.6139

PHILLIPS-PERRON (PP) TEST: FIRST DIFFERENCES

Variables	**Intercept**	**With Intercept and Trend**	**Without Trend and Intercept**
$ln\ (Y/L)$	- 9.2369	-10.0494	-7.7179
$ln(L)$	-7.4632	-7.9309	-3.7517
$ln(K_p)$	-4.7302	-4.6162	-3.5503
$ln(K_f)$	-6.6096	-6.6642	-5.4648
$ln(K_g)$	-2.7011	-10.5338	-10.6272
$ln(RER)$	-8.2090	-8.1084	- 8.1955

Note: the critical values of the PP test with intercept, with trend and intercept and without trend or intercept at significance levels of 1%, 5% and 10% are respectively: -3.5242, -2.9024, -2.5886; -4.0906, -3.4734, -3.1640; -2.5975, -1.9454,-1.6138.

COINTEGRATION TESTS USING THE JOHANSEN-JUSELIUS METHOD

Null Hypothesis	Alternative Hypothesis	Trace Value	Critical Value 95%
r=0	r > 0	174.528	103.847
r≤ 1	r >1	111.256	76.973
r≤2	r >2	74.697	54.079
r≤ 3	r >3	44.415	35.193
r≤4	r >4	23.697	20.262
Max Test λ	**Max Text λ**	**Max Values of λ**	**Critical Value 95%**
r=0	r = 1	63.272	40.957
r=1	r = 2	36.560	34.806
r=2	r = 3	30.282	28.588
r=3	r = 4	20.718	22.300
r=4	r = 5	12.608	15.892

Note: '***r***' refers to the number of cointegration vectors.

STRUCTURAL CHANGE (1941-2013)

Null Hypothesis: No breakpoints within 15% trimmed data
Varying regressors: All equation variables
Equation Sample: 1940 2013
Test Sample: 1952 2002
Number of breaks compared: 51

Statistic	Value	Prob.
Maximum Wald F-statistic (1979)	234.741	0.0000
Exp Wald F-statistic	113.550	0.0000
Ave Wald F-statistic	85.162	0.0000

Note: probabilities calculated using Hansen's (1997) method

ERROR CORRECTION MODEL

We began be estimating the long-term relationship for the 1940-1979 period:

$$ln(PIB/L)_t = 1.716 \ - 0.624\ l_t + 0.079\ k_{p,t} + 0.096\ k_{f,t} + 0.530\ k_{g,t} - 0.153\ rer$$

(2.31) (-3.65) (2.34) (2.65) (1218) (-5.05)

From these results we find the series of residuals $\hat{e} \equiv ect_t$. We can use this information to estimate the equation by OLS, obtaining the results shown in Table:

1940-1979

DEPENDENT VARIABLE: $\mathbf{\Delta y_t - \Delta l_t}$

Variable	**Coefficient**	**Standard Error**	***t* statistic**	**Prob.**
Intercept	0.004	0.009	0.467	0.644
Δl_t	-0.278	0.231	-1.205	0.239
$\Delta k_{p,t}$	0.049	0.026	1.862	0.074
$\Delta k_{f,t}$	0.082	0.019	4.264	0.000
$\Delta k_{g,t}$	0.393	0.072	5.477	0.000
Δrer_t	-0.109	0.025	-4.326	0.000
ect_{t-1}	-0.584	0.116	-5.030	0.000

n=39 after adjustments. $R^2 = 0.81$, $\underline{R}^2 = 0.73$; DW: 2.04. Akaike information criteria: -5.84. In the remainder normality test, Jarque Bera's coefficient was JB=0.189, with a probability of 0.91 and a kurtosis value of 2.71. The Breusch-Godfrey auto-correlation tests of the Lagrange multiplier, with two lags, produces the following results: F = 0.082 < F(2,25) = 3.39, with which we cannot reject the null hypothesis, at the level of significance of 1%. the Ramsey RESET tests for linearity produced the following result: F: 1.010 < $F_{(1,26)}$ = 7.6 at the 5% significance level, with which we cannot reject the null hypothesis of linearity in the regression equation. The Breusch-Pagan-Godfrey heteroscedasticity test gives a statistic F of 1.033 < $F_{(11,27)}$ = 2.13 at the 5% level, with which we can reject the null hypothesis for the existence of heteroscedasticity.

We use the same procedure for the second period:

1984-2013

DEPENDENT VARIABLE: $\Delta y_t - \Delta l_t$

Variable	Coefficient	Standard Error	t Statistic	Prob.
Intercept	- 0.005	0.006	- 0.857	0.403
Δl_t	- 0.272	0.162	- 1.673	0.112
$\Delta k_{p,t}$	0.245	0.081	3.028	0.007
$\Delta k_{f,t}$	0.116	0.037	3.155	0.006
$\Delta k_{g,t}$	0.122	0.056	2.163	0.044
Δrer_t	- 0.016	0.012	- 1.265	0.222
ect_{t-1}	- 0.419	0.091	- 4.590	0.000

n=30, after adjustments. R^2 = 0.94, $\underline{R}^2$ = 0.90; DW: 2.29. Akaike information criteria: -6.37. In the remainder normality test, Jarque Bera's coefficient was JB=0.231, with a probability of 0.0.89 and a kurtosis value of 2.16. The Ramsey RESET tests for linearity produced the following result: F: 0.216 < F(1,17) = 4.45 at the 5% significance level, with which we cannot reject the null hypothesis of linearity in the regression equation. The Breusch-Pagan-Godfrey heteroscedasticity test gives the following results: F: 0.510 < F(11,18) = 2.34 at the 5% level, with which we cannot reject the null hypothesis for heteroscedasticity. The Breusch-Godfrey serial correlation test (LM test) gives a value of F: 0.599 < F(1,16) = 4.49.

ANNUAL AVERAGE GROWTH RATES

	1940- 1982	1983-2013	1983-1993	1994-2013
GDP	6.00%	2.25%	1.86%	2.47%
Pop	2.86%	1.57%	2.05%	1.30%
L	3.22%	1.83%	1.98%	1.74%
GDP/Pop	3.15%	0.68%	-0.19%	1.17%
GDP/L	2.78%	0.43%	-0.13%	0.73%
L/Pop	0.36%	0.26%	-0.07%	0.43%

GDP: real GDP; *POP*: Population; *EMP*: Economically Active Population.

The data used to calculate the rates were sourced from: Nacional Financiera, *La Economía Mexicana en Cifras*, 1978; INEGI, *Estadísticas Históricas de México*, 1999; Presidencia de la República, government report, multiple years**.**

Both estimates show a positive effect of foreign fixed capital (accumulation of FDI), domestic private and government, on labor productivity, but with very different values which reflects the importance of structure to determine the impact of FDI.

In the first period of growth, it is led by government investment, but it is also found that the impact of foreign investment on labor productivity is slightly greater than that of private domestic capital (which indicates the existence of externalities, possibly facilitated by structure factors such as national content requirement, obligation to associate with domestic investors up to 49%, export commitments, etc.)

In the second period, growth is led by domestic private investment, complemented by government capital; foreign capital plays a secondary role. Surprisingly the effect of accumulated foreign investment is found to have a much smaller effect, which could be explained by the structural change itself, which allows companies to be totally foreign-owned, hence there is no domestic capital that could benefit from that association; the new model also does not require national content, discouraging any possible linkages or spill overs.