

The U.S. and Mexico: Are We Still Connected?
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Maquila: volatility and Mexico-US economic integration

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Motivation

- Closed economy and core regional pattern
 - Main market
 - Scale Economies
 - Transportation cost
 - Infrastructure
- Free trade (NAFTA) and northern industrialization
 - Bigger market
 - Scale Economies
 - Transportation cost

Some Facts

1. Increasing manufacturing industry in border cities
 2. But not in cities of non-border states
 3. Decreasing manufacturing industry in Mexico City region
 4. Other regions do not present percentage changes
- 1 is caused by high growth of the maquila industry
 - 2 because those cities are less maquila intensive and more domestic market oriented
 - 3 and 4 because those regions are more domestic oriented

Manufacturing Industry: Regional pattern

Regions	Employment			Production		
	1988	1993	1998	1988	1993	1998
<i>Regions by States</i>						
Northern border	27.7	29.8	34.1	26.0	23.8	30.5
North	6.9	7.5	7.1	4.4	5.4	6.7
Center	27.5	28.2	30.0	27.4	29.0	31.1
México City	33.4	28.7	23.3	38.2	37.3	28.2
South	4.6	5.7	5.4	3.9	4.6	3.4
<i>Regions by municipalities</i>						
Selection (1)	85.2	82.3	81.2	88.8	87.5	86.8
Northern border	26.2	28.0	31.8	24.3	22.1	28.9
First line	11.3	13.3	16.7	5.3	6.5	10.1
Second line	14.9	14.7	15.1	18.9	15.5	18.8
North	4.7	5.2	4.8	3.4	4.2	5.1
Center	20.4	19.5	20.4	21.9	22.5	24.1
México City	31.2	26.5	21.5	36.6	35.1	26.3
South	2.6	3.1	2.7	2.6	3.6	2.4

Fuente: based on INEGI, Censos Industriales de 1989, 1994 y 1999.

(1) With 25 thousands or more inhabitants

Regional employment: Maquila and Manufacturing industry						
Descripción	Employment			Percentage		
	1988	1993	1998	1988	1993	1998
Manufacturing industry	2,640,472	3,246,042	4,232,322	100	100	100
Main border cities (1)	272,557	393,920	641,539	10.3	12.1	15.2
Other cities in border States	457,898	574,706	803,364	17.3	17.7	19
Non border Sates cities	1,910,017	2,277,416	2,787,419	72.3	70.2	65.9
Maquila in México	369,489	542,074	966,763	14	16.7	22.8
Main border cities (1)	235,351	341,815	571,593	8.9	10.5	13.5
Other cities in border States	108,138	123,753	209,459	4.1	3.8	4.9
Non border Sates cities	26,001	76,506	185,711	1	2.4	4.4
Manufacturing without Maquila	2,270,983	2,703,968	3,265,560	86	83.3	77.2
Main border cities (1)	37,206	52,105	69,946	1.4	1.6	1.7
Other cities in border States	349,760	450,953	593,905	13.2	13.9	14
Non border Sates cities	1,884,017	2,200,910	2,601,708	71.4	67.8	61.5
Increasing amount due to Maquila	<u>1988-1993</u>		<u>1993-1998</u>		<u>1988-1998</u>	
Main border cities (1)	87.7		92.8		91.1	
Other cities in border States	13.4		37.5		29.3	
Non border Sates cities	13.7		21.4		18.2	

(1) Tijuana, Tecate, Mexicali, Nogales, Ciudad Juárez, Nuevo Laredo, Reynosa y Matamoros

Remarks

- A big proportion of employment growth is generated by the maquila industry, mainly in border cities
- Then, most of the economic integration among Mexico and USA has been supported by low wages
- Exceptions: some industries far away from the border, which have combined low wages with economies of agglomeration, vertical linkages and other advantages of location that compensate the saving in transportation costs

How volatile is the maquila employment with respect to wages in México and demand in the USA?

Model: Labor Demand in Maquila Industry

Dynamic Panel Data:

$$Ltrab_{it} = \alpha_0 + \alpha_1 Ltrab_{i(t-1)} + \alpha_2 Ltrab_{i(t-2)} + \beta_1 Lrppd_{it} + \beta_2 Lpibusa_{it} + v_i + u_{it}$$

t= 1990.1 – 2005.3 quarterly

i = The Following 13 States where maquila mainly operates: Baja California, Sonora, Chihuahua, Coahuila, Nuevo León, Tamaulipas, Durango, Aguascalientes, Jalisco, Guanajuato, Mexico-DF, Puebla y Yucatán.

Variables:

Ltrab= log of maquila employment

Lrppd = wage per worker in dollars

Lpibusa = log of: USA GDP (2000 prices) over distance

Model: Labor Demand in Maquila Industry

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Arellano-Bond dynamic panel-data estimation      Number of obs   =      695
Group variable (i): estado                       Number of groups =      13
Wald chi2(4) = 18500.45
Time variable (t): trim                         Obs per group: min =     35
                                                    avg = 53.46154
                                                    max =     59
    
```

One-step results

D.ltrab		Coef.	Std. Err.	z	P> z	[95% Conf. Interval]

ltrab						
	LD	1.220175	.0362107	33.70	0.000	1.149204 1.291147
	L2D	-.262198	.0355168	-7.38	0.000	-.3318095 -.1925864
lrppd						
	D1	-.0804483	.0115187	-6.98	0.000	-.1030246 -.0578721
lpibusa						
	D1	.4801248	.1643802	2.92	0.003	.1579454 .8023041
_cons						
		-.0023032	.0012531	-1.84	0.066	-.0047592 .0001528

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Sargan test of over-identifying restrictions:
chi2(1827) = 695.25 Prob > chi2 = 1.0000
Arellano-Bond test that average autocovariance in residuals of order 1 is 0:
H0: no autocorrelation z = -13.42 Pr > z = 0.0000
Arellano-Bond test that average autocovariance in residuals of order 2 is 0:
H0: no autocorrelation z = -1.30 Pr > z = 0.1927
    
```

In States where maquila mainly operate:

How intense the relationship among regional manufacturing GDP and maquila employment is?

And the same for no maquila manufacturing employment?

SAME MODEL: FOR 5 BORDER STATES “ENCUESTA INDUSTRIAL” IS AVAILABLE

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RE GLS regression with AR(1) disturbances      Number of obs      =      45
Group variable (i): edo                      Number of groups   =      5

R-sq:  within = 0.8062                      Obs per group: min =      9
       between = 0.9911                      avg =              9.0
       overall = 0.9746                      max =              9

corr(u_i, Xb) = 0 (assumed)                  Wald chi2(3)       =     696.99
                                              Prob > chi2        =     0.0000
    
```

lpib	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
leim	.751979	.0286327	26.26	0.000	.69586	.808098
lema	.4741145	.032842	14.44	0.000	.4097455	.5384836
_cons	2.926822	.6166037	4.75	0.000	1.718301	4.135343
rho_ar	.30036224	(estimated autocorrelation coefficient)				
sigma_u	.03286393					
sigma_e	.05867365					
rho_fov	.23880722	(fraction of variance due to u_i)				
theta	.3693034					

modified Bhargava et al. Durbin-Watson = 1.0161248
 Baltagi-Wu LBI = 1.4223837

SAME MODEL: 8 NON BORDER STATES WHERE MAQUILA MAINLY OPERATE AND “ENCUESTA INDUSTRIAL” IS AVAILABLE

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RE GLS regression with AR(1) disturbances      Number of obs      =      72
Group variable (i): edo                      Number of groups   =      8

R-sq:  within = 0.5067                      Obs per group: min =      9
       between = 0.9805                      avg =              9.0
       overall = 0.9708                      max =              9

corr(u_i, Xb) = 0 (assumed)                  Wald chi2(3)       =     844.88
                                              Prob > chi2        =     0.0000
    
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lpib	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
leim	1.006813	.0353467	28.48	0.000	.9375342	1.076091
lema	.0931754	.0317849	2.93	0.003	.0308781	.1554726
_cons	4.270437	.5570855	7.67	0.000	3.178569	5.362304
rho_ar	.5447997	(estimated autocorrelation coefficient)				
sigma_u	.09118054					
sigma_e	.08925897					
rho_fov	.5106482	(fraction of variance due to u_i)				
theta	.46267575					

modified Bhargava et al. Durbin-Watson = .53157542
 Baltagi-Wu LBI = .98430456

How intense the relationship among the Mexican manufacturing industry and the USA economy is?

And what about the domestic market?

Linkages between regional manufacturing industry and Mexican domestic and USA market

Dinamyc Panel Data Model:

$$lpibe_{it} = \alpha_0 + \alpha_1 Lpibe_{i,t-1} + \beta_1 Ldpibms_{it} + \beta_2 Ldpibus_{it} + v_i + u_{it}$$

t = 1993 – 2003, yearly

i= All 32 States

Variables:

lpibe = log of State manufacturing industry GDP (1993 prices)

Ldpibms = log (GDP_t / GDP_{t-1}) in México (pibe was previously subtracted)

Ldpibus = log of USA GDP (2000 prices)

SAME MODEL: 20 STATES WITH LEAST FOREIGN INVESTMENT

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Arellano-Bond dynamic panel-data estimation      Number of obs      =      180
Group variable (i): edol                        Number of groups   =      20

                                                Wald chi2(3)       =      309.19

Time variable (t): anio                         Obs per group: min =      9
                                                avg =              9
                                                max =              9
    
```

Two-step results

D.lpipe		Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
lpibe	LD	.6335109	.0420705	15.06	0.000	.5510542	.7159676
ldpibms	D1	.4564376	.0695026	6.57	0.000	.320215	.5926603
ldpibus	D1	.3732458	.2703256	1.38	0.167	-.1565828	.9030743
_cons		.012095	.000965	12.53	0.000	.0102037	.0139863

Sargan test of over-identifying restrictions:
 chi2(79) = 19.36 Prob > chi2 = 1.0000

Arellano-Bond test that average autocovariance in residuals of order 1 is 0:
 H0: no autocorrelation z = -3.17 Pr > z = 0.0015
 Arellano-Bond test that average autocovariance in residuals of order 2 is 0:
 H0: no autocorrelation z = 0.18 Pr > z = 0.8588

Concluding remarks

- The increasing border industrialization has been caused by maquila growth
- Maquila is volatile relative to wages
- Maquila is sensible to USA market
- Since maquila is not locally integrated, USA market could be supplied from other lower wage locations
- The more maquila intensive a region is, it becomes more connected to the USA economy, and less connected to the Mexican domestic Market

- Away from the border, regional GDP is less sensitive to maquila and more sensitive to other industries which are more locally integrated
- Locally integrated industries could be less sensitive to wages and more to vertical linkages, agglomeration economies, domestic market performance and other regional advantages
- Some regions, even non border regions, with high foreign investment are also more connected to the USA economy