

On the Statics and Dynamics of Net External Assets⁺

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Abstract

The paper examines some static and dynamic aspects of net external assets for U.S. states and countries. The ratio of net external assets to output depends positively on output per capita and positively on total output for countries and negatively on output per capita and positively on total output for U.S. states. The ratio of the absolute value of net external assets to output depends negatively on total output both for U.S. states and countries. The growth of net external assets is related to the growth of output per capita negatively for U.S. states and positively for countries. There exists a strong tendency for σ convergence and β convergence of net external assets for U.S. states in the 1977-1992 period and a strong tendency for σ divergence and a very weak tendency for β convergence for countries in the 1970-1987 period.

Keywords: Convergence; Net external assets; Output

JEL classification: F21, F41

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1. Introduction

Net external assets (NEA) constitute a fundamental macroeconomic variable. NEA measure the position of an economy on the world credit market. NEA are positive for net creditors and negative for net debtors. Developed countries are both net creditors (Japan, Switzerland) and net debtors (Australia, Canada, the United States). Developing countries are typically net debtors. Oil exporting countries are frequently strong net creditors.

This paper examines the behavior of NEA in the samples of U.S. states and countries. The paper discusses the relationships between NEA and real output per capita, between NEA and total output, between the absolute value of NEA and total output, and between the growth of NEA and the growth of output per capita. Additionally, the paper sheds some light on the issue of β convergence and σ convergence for NEA.

An open-economy macroeconomics is developed, for example, in Barro and Sala-i-Martin (1995, Chapter 3), or in Obstfeld and Rogoff (1996). It is well known that the introduction of capital mobility in the neoclassical growth model is problematic. With perfect capital mobility, the neoclassical growth model predicts immediate jumps of capital and output to their steady-state levels. This contradicts the empirically observed slow convergence (see Barro and Sala-i-Martin, 1995, Chapters 11 and 12). Moreover, the behavior of consumption is counterfactual – the least patient economies asymptotically mortgage all their assets including future discounted wages. The behavior of the neoclassical growth model is improved if we introduce borrowing restrictions (see Cohen and Sachs, 1986, or Barro, Mankiw, and Sala-i-Martin, 1995). Credit-constrained economies converge slowly. However, Duczynski (2000) shows that most economies are likely to be unconstrained. Alternatively, an open-economy neoclassical growth model is improved if there are large adjustment costs for capital investment. Duczynski (2002) develops a neoclassical growth model with differential adjustment costs for human and physical capital and shows that the model is empirically plausible if there are large adjustment costs for human capital.

Empirical studies examining international borrowing include, for example, Cohen (1992), Lane (1997), and Lane and Milesi-Ferretti (2001). Cohen (1992) claims that access to world financial markets can speed up capital accumulation and growth, but

he finds no evidence for it in the group of large debtors in the 1970s. Lane (1997) shows that there is a positive relationship between the level of initial output and external debt and that there is a positive association between trade openness and external debt. Lane and Milesi-Ferretti (2001) present estimates of foreign assets and liabilities for 67 industrial and developing countries and they characterize stylized facts of international balance sheets.

In the present paper, we make three theoretical hypotheses concerning the relationship of NEA and real output. First, the ratio of NEA to output should depend positively on output per capita if the sample includes very poor economies. The fact that very poor economies should be net debtors follows if we assume that individuals have Stone-Geary preferences:

$$U(c)=[(c-c^*)^{1-2}-1]/(1-2), \quad (1)$$

where $U(c)$ is utility, c is consumption, c^* is the subsistence level of consumption, and 2 is a positive parameter (inverse elasticity of intertemporal substitution if $c^*=0$). The Stone-Geary preferences imply very low values of utility if consumption is close to its subsistence level (in particular if $2>1$). Because economies are expected to grow over time, it is optimal for poor economies to shift consumption from the future to the present to avoid very low values of consumption at present. Such economies borrow on the international credit market. Very poor economies exist across countries but are absent across U.S. states. Thus we can predict that the ratio of NEA to output depends positively on output per capita only among countries. This prediction is empirically confirmed. Alternatively, poor countries may be net debtors because of myopia. It is plausible that poor people, with very little education, tend to be irrational. They borrow even if it is not optimal.

Second, the economic intuition predicts some relationship for the absolute value of NEA and total output. Total output indicates the size of an economy. Larger economies tend to be less open to international trade and international capital flows than smaller economies. Less open economies should have smaller ratios of $|NEA|$ to GDP. Thus there should be a negative relationship between total GDP and the ratio of $|NEA|$ to GDP. This is empirically confirmed, although the given negative relationship is statistically significant only in some cases.

Third, the growth of NEA should be negatively related to the growth of output per capita if international (interregional) capital flows are efficient. In the economic theory, there are two main forces that drive the evolution of NEA: consumption smoothing and domestic investment opportunities. If an open economy is below its steady state, it should have high rates of return on capital. In addition, the expected future income is high relative to the present income, and there is some tendency to shift consumption from the future to the present. Such an economy should borrow on the international credit market; in other words, it should have persistent current-account deficits and decreases in NEA. A similar logic applies for economies that are above their steady states; these economies should have current-account surpluses and increases in NEA. Since economies grow faster the further they are below their steady states (conditional β convergence), one can conclude that the economic theory provides some support for a negative relationship between the growth of NEA and the growth of real output per capita. This prediction is confirmed for U.S. states but not for countries. It is plausible that international capital flows were inefficient; countries that attracted foreign capital were not able to use it to achieve rapid growth on average.

On the other hand, we see no theoretical prediction for the relationship between the NEA/GDP level and the level of total output. Similarly, we have no prior expectation regarding the convergence or divergence behavior of NEA.

For the U.S. states, the ratios of NEA to gross state product (GSP) for 1977, 1982, 1987, and 1992 are available from Duczynski (2000). These estimates have been constructed from the data on state personal income (SPI) and GSP. The data on SPI and GSP are available from the web site of the Bureau of Economic Analysis (<http://www.bea.doc.gov>). Population estimates (and corresponding per capita SPI and GSP estimates) were not available for 1992 at the time this paper was being written. For the countries, the ratios of NEA to GDP in 1990 are available from the unpublished Appendix Table for Duczynski (2000). These estimates have been derived by cumulating the current account in the 1970-1990 period. In the present paper, we exclude observations in which direct Summers-Heston data (version 5.6) for output are not available for 1990, so that the sample of countries contains 98 observations. Additional estimates of NEA/GDP are available from Sinn (1990) for

1970-1987. The data on output are taken from the Summers-Heston data set (see Summers and Heston, 1991, and the web site <http://pwt.econ.upenn.edu/>).

2. U.S. states

2.1. NEA/GSP and GSP per capita

The following are the regressions for 1977, 1982, and 1987, respectively, for 51 U.S. states (GSP/CAP denotes GSP per capita):

Year	NEA/GSP	Coefficient	t-stat.	R ²
1977	Constant	0.75	2.12	
	GSP/CAP	$-7.73 \cdot 10^{-5}$	-2.08	
				0.08
1982	Constant	1.44	5.43	
	GSP/CAP	$-1.04 \cdot 10^{-4}$	-6.22	
				0.44
1987	Constant	0.79	3.17	
	GSP/CAP	$-4.41 \cdot 10^{-5}$	-3.56	
				0.21

Table 1

GSP/CAP is expressed in current U.S. dollars. Alaska and District of Columbia are outliers with very high values of GSP per capita. If these two states are excluded, the regressions take the form:

Year	NEA/GSP	Coefficient	t-stat.	R ²
1977	Constant	1.42	2.15	
	GSP/CAP	$-1.56 \cdot 10^{-4}$	-2.06	
				0.08
1982	Constant	2.30	4.39	
	GSP/CAP	$-1.70 \cdot 10^{-4}$	-4.41	
				0.29
1987	Constant	0.53	1.29	
	GSP/CAP	$-2.87 \cdot 10^{-5}$	-1.29	
				0.03

Table 2

Except for this last example, there exists a statistically significant negative relationship between NEA/GSP and GSP per capita. Rich states have a tendency to be net debtors.

2.2. NEA/GSP and SPI per capita

The following are the regressions for 1977, 1982, and 1987, respectively, for 51 U.S. states:

Year	NEA/GSP	Coefficient	t-stat.	R ²
1977	Constant	-0.13	-0.21	
	SPI/CAP	$2.42 \cdot 10^{-5}$	0.28	
				0.00
1982	Constant	1.21	1.30	
	SPI/CAP	$-1.11 \cdot 10^{-4}$	-1.39	
				0.04
1987	Constant	-0.05	-0.09	
	SPI/CAP	$-4.5 \cdot 10^{-7}$	-0.01	
				0.00

Table 3

Alaska is an outlier with a very high value of SPI per capita. If Alaska is excluded, the regressions take the following form:

Year	NEA/GSP	Coefficient	t-stat.	R ²
1977	Constant	-1.36	-1.88	
	SPI/CAP	$2.01 \cdot 10^{-4}$	1.99	
				0.08
1982	Constant	-1.12	-1.28	
	SPI/CAP	$1.00 \cdot 10^{-4}$	1.32	
				0.03
1987	Constant	-0.54	-1.25	
	SPI/CAP	$3.44 \cdot 10^{-5}$	1.26	
				0.03

Table 4

Except for equation for 1977, there is no statistically significant relationship between NEA/GSP and SPI per capita.

2.3. NEA/GSP and total GSP

The following are the regressions for 1977, 1982, 1987, and 1992, respectively, for 51 U.S. states (the total GSP is expressed in millions of current dollars):

Year	NEA/GSP	Coefficient	t-stat.	R ²
1977	Constant	-0.03	-0.21	
	GSP	1.83*10 ⁻⁶	0.8	
				0.01
1982	Constant	-0.16	-0.82	
	GSP	1.49*10 ⁻⁶	0.75	
				0.01
1987	Constant	-0.10	-0.88	
	GSP	4.6*10 ⁻⁷	0.60	
				0.01
1992	Constant	-0.20	-2.31	
	GSP	3.8*10 ⁻⁷	0.84	
				0.01

Table 5

The dispersion of total GSP across the states is relatively large; thus, it may be of interest to replace the level of GSP with the logarithm of GSP. For NEA/GSP depending on the logarithm of GSP, the regressions for 1977, 1982, 1987, and 1992, respectively, take the form:

Year	NEA/GSP	Coefficient	t-stat.	R ²
1977	Constant	-0.59	-0.58	
	Ln(GSP)	0.063	0.62	
				0.01
1982	Constant	-1.71	-1.09	
	Ln(GSP)	0.156	1.05	
				0.02
1987	Constant	-0.89	-0.97	
	Ln(GSP)	0.076	0.91	
				0.02
1992	Constant	-1.24	-1.72	
	Ln(GSP)	0.097	1.51	
				0.04

Table 6

Thus the relationship between NEA/GSP and GSP is positive in all cases but insignificant.

2.4. $|NEA|/GSP$ and total GSP

The following are the regressions for 1977, 1982, 1987, and 1992, respectively, for 51 U.S. states:

Year	$ NEA / GSP$	Coefficient	t-stat.	R^2
1977	Constant	0.55	5.80	
	GSP	$-9.7 \cdot 10^{-7}$	-0.61	
				0.01
1982	Constant	0.74	5.16	
	GSP	$-8.3 \cdot 10^{-7}$	-0.56	
				0.01
1987	Constant	0.48	5.91	
	GSP	$-7.4 \cdot 10^{-7}$	-1.31	
				0.03
1992	Constant	0.39	6.13	
	GSP	$-2.9 \cdot 10^{-7}$	-0.89	
				0.02

Table 7

For $|NEA|/GSP$ depending on the logarithm of GSP, the regressions for 1977, 1982, 1987, and 1992, respectively, are:

Year	$ NEA / GSP$	Coefficient	t-stat.	R^2
1977	Constant	1.41	1.99	
	Ln(GSP)	-0.089	-1.27	
				0.03
1982	Constant	1.51	1.28	
	Ln(GSP)	-0.077	-0.70	
				0.01
1987	Constant	1.65	2.50	
	Ln(GSP)	-0.113	-1.89	
				0.07
1992	Constant	1.42	2.72	
	Ln(GSP)	-0.095	-2.05	
				0.08

Table 8

Thus there exists a negative relationship between the size of the economy and the absolute value of NEA relative to GSP. However, except for the last regression, this relationship is not statistically significant.

2.5. Change of NEA/GSP and growth of GSP per capita

This section examines the relationship between $\Delta(\text{NEA/GSP}) = (\text{NEA/GSP})_{1987} - (\text{NEA/GSP})_{1977}$ and the total growth of nominal¹ GSP per capita between 1977 and 1987 (in %). The sample average of this growth (denoted by GSPG) is 112.1%, and the standard deviation makes 27.1%.

$$\Delta(\text{NEA/GSP}) = 1.77 - 0.017 \text{ GSPG}, \quad (2)$$

(9.66) (-10.49)

where R^2 is 0.69. Thus there exists a strongly significantly negative relationship between the growth of NEA and the growth of GSP per capita. It is plausible that technologically growing states attracted physical capital, which even reinforced the positive effect on output.

2.6. Change of NEA/GSP and growth of SPI per capita

This section replicates the previous section's analysis, with GSP replaced by SPI:

$$\Delta(\text{NEA/GSP}) = 1.37 - 0.013 \text{ SPIG}, \quad (3)$$

(3.35) (-3.65)

where R^2 is 0.21. Alaska is an outlier with extremely low growth of SPI per capita. If Alaska is excluded, the regression takes the form

$$\Delta(\text{NEA/GSP}) = 2.32 - 0.020 \text{ SPIG}, \quad (4)$$

(6.77) (-7.06)

where R^2 is 0.51. Again, there exists a strongly significantly negative relationship between the growth of NEA and the growth of income per capita. This relationship can be explained if one considers the possibility that technologically growing states attracted physical capital.

¹ Price indexes for individual U.S. states are not available. The growth of nominal GSP is proportional to the growth of real GSP if relative price levels are stable across the states.

2.7. Convergence of NEA

This section examines the dependence of the change in NEA/GSP on the initial NEA/GSP level (β convergence). It also mentions how the dispersion of NEA/GSP evolved over time (σ convergence). The following are the regressions for the 1977-82, 1982-87, 1987-92, and 1977-92 periods, respectively:

Year	Δ (NEA) / GSP	Coefficient	t-stat.	R ²
1977-82	Constant	-0.11	-1.59	
	(NEA/GSP) ₁₉₇₇	0.25	2.46	
				0.11
1982-87	Constant	-0.03	-0.55	
	(NEA/GSP) ₁₉₈₂	-0.51	-11.07	
				0.71
1987-92	Constant	-0.11	-4.57	
	(NEA/GSP) ₁₉₈₇	-0.28	-6.88	
				0.49
1977-92	Constant	-0.17	-3.36	
	(NEA/GSP) ₁₉₇₇	-0.57	-8.18	
				0.58

Table 9

Thus, except for the 1977-82 period, there exists a statistically strong tendency towards β convergence. The standard deviations of NEA/GSP in the sample of 51 U.S. states are 0.73 in 1977, 1.04 in 1982, 0.61 in 1987, and 0.47 in 1992. Except for the 1977-82 period, there exists a tendency for σ convergence.

2. Countries

3.1. NEA/GDP and GDP per capita

In the sample of 98 countries for which we have current-account based estimates of NEA and estimates of real output per capita expressed in current U.S. dollars (CGDP variable in the Summers-Heston data set) for 1990, the regression takes the form:

Year	NEA / GDP	Coefficient	t-stat.	R ²
1990	Constant	-0.28	-6.51	
	CGDP	$1.56 \cdot 10^{-5}$	3.18	
				0.10

Table 10

If the CGDP variable is taken in its logarithm, the regression is

Year	NEA / GDP	Coefficient	t-stat.	R ²
1990	Constant	-0.95	-4.26	
	Ln(CGDP)	0.094	3.48	
				0.11

Table 11

Additional estimates of NEA/GDP are available from Sinn (1990) for the 1970-1987 period. We carried out regressions for 1970, 1980, and 1987. We measured GDP per capita by the RGDPCH variable in the Summers-Heston data set (reflecting the chained real output expressed in constant U.S. dollars). For 1970, 1980, and 1987 the regressions take the following forms:

Year	NEA / GDP	Coefficient	t-stat.	R ²	Number of observations
1970	Constant	-0.25	-4.89		
	RGDPCH	3.46×10^{-5}	3.11		
				0.08	116
	Constant	-0.75	-2.66		
	Ln(RGDPCH)	0.081	2.21		
				0.04	
1980	Constant	-0.27	-4.97		
	RGDPCH	3.09×10^{-5}	4.26		
				0.13	124
	Constant	-1.32	-4.27		
	Ln(RGDPCH)	0.151	3.94		
				0.11	
1987	Constant	-0.77	-9.21		
	RGDPCH	8.48×10^{-5}	6.97		
				0.29	121
	Constant	-3.38	-7.72		
	Ln(RGDPCH)	0.379	6.98		
				0.29	

Table 12

As measured by the t-statistics, NEA/GDP depends significantly positively on real output per capita. Poor countries have a tendency to be net debtors. As stated in the introduction, this can be explained if there are Stone-Geary preferences (people in poor countries try to avoid extremely low consumption and borrow internationally) or if people in poor countries are myopic (perhaps due to a lack of education).

3.2. NEA/GDP and total GDP

For the 98 countries with current-account based estimates of NEA for 1990, the regressions are (total GDP is constructed from the CGDP variable and population estimates; the GDP variable is expressed in billions of U.S. dollars):

Year	NEA / GDP	Coefficient	t-stat.	R ²
1990	Constant	-0.20	-6.18	
	GDP	9.60*10 ⁻⁵	1.99	
				0.04
	Constant	-0.46	-8.33	
	Ln(GDP)	0.078	5.81	
				0.26

Table 13

We also ran regressions for 1970, 1980, and 1987 using the NEA/GDP estimates from Sinn (1990). The total GDP was constructed from the RGDPCH variable and population estimates; it was expressed in billions of U.S. dollars. The regressions for 1970, 1980 and 1987 are

Year	NEA / GDP	Coefficient	t-stat.	R ²	Number of observations
1970	Constant	-0.14	-3.82		
	GDP	1.35*10 ⁻⁴	1.01		
				0.01	116
	Constant	-0.22	-2.42		
	Ln(GDP)	0.033	1.72		
				0.03	
1980	Constant	-0.12	-2.74		
	GDP	8.61*10 ⁻⁵	0.71		
				0.00	124
	Constant	-0.17	-1.38		
	Ln(GDP)	0.020	0.89		
				0.01	
1987	Constant	-0.38	-5.24		
	GDP	1.83*10 ⁻⁴	1.18		
				0.01	121
	Constant	-0.56	-3.03		
	Ln(GDP)	0.069	2.05		
				0.03	

Table 14

Thus the relationship between NEA/GDP and GDP is always positive. However, it is significant only in some cases.

3.3. *|NEA|/GDP and total GDP*

For the 98 countries with current-account based estimates of NEA for 1990, the regressions are:

Year	<i> NEA / GDP</i>	Coefficient	t-stat.	R ²
1990	Constant	0.26	9.07	
	Total GDP	-6.30*10 ⁻⁵	-1.52	
				0.02
	Constant	0.44	8.69	
	Ln(total GDP)	-0.054	-4.44	
				0.17

Table 15

Using the estimates of NEA/GDP from Sinn (1990), the regressions for 1970, 1980, and 1987 are

Year	<i> NEA / GDP</i>	Coefficient	t-stat.	R ²	Number of observations
1970	Constant	0.29	9.97		
	GDP	-1.52*10 ⁻⁴	-1.46		
				0.02	116
	Constant	0.37	4.41		
	Ln(GDP)	-0.036	-2.48		
				0.05	
1980	Constant	0.36	10.54		
	GDP	-1.89*10 ⁻⁴	-2.10		
				0.03	124
	Constant	0.52	5.85		
	Ln(GDP)	-0.063	-3.87		
				0.11	
1987	Constant	0.65	12.62		
	GDP	-2.81*10 ⁻⁴	-2.51		
				0.05	121
	Constant	0.89	6.15		
	Ln(GDP)	-0.089	-3.70		
				0.10	

Table 16

Thus there exists a negative relationship between $|NEA|/GDP$ and total GDP. This relationship is typically significant, in particular if GDP is included in its logarithm. The given result corresponds to the fact that larger economies are less open to international capital flows. This corresponds to Lane (1997), who observes that there tends to be a positive association between trade openness and external debt.

3.4. Growth of NEA and growth of real GDP per capita

For the 98 countries, the NEA estimates for 1990 are based on the current account cumulated in the 1970-1990 period. Consequently, the NEA estimates reflect the change in NEA in 1970-1990. This section examines how the NEA/GDP estimates for 1990 are related to the growth of real GDP per capita in 1970-1990. This growth (in %) is based on RGDPCH variable from the Summers-Heston data set. The sample average of this growth is 47.9%, and the standard deviation equals 66.5%. The sample contains 97 countries (the 1970 RGDPCH data are not available for Western Samoa). The relationship between NEA/GDP and the growth of GDP per capita (denoted by RGDPCHG) is reflected in the following regression:

$$NEA/GDP = -0.26 + 0.0017 RGDPCHG, \quad (5)$$

(-7.14) (3.75)

where R^2 is 0.13. The sample average of NEA/GDP is -0.18 (standard deviation 0.31). In the sample of 22 countries with declining RGDPCH between 1970 and 1990, the average NEA/GDP for 1990 is -0.40 (standard deviation 0.47). This is significantly different from -0.18 (the t-statistic is 2.20). In the sample of 14 countries with the rapid growth of RGDPCH (above 100%), the average NEA/GDP is -0.06 (standard deviation 0.28). This is marginally significantly different from -0.18 (the t-statistic is 1.60). The observed positive relationship between the growth of NEA and the growth of real output per capita stands in contrast to the observation for the U.S. states. It is possible that this relationship reflects **inefficiencies** in international lending.

In addition, we ran a similar regression using the NEA/GDP data from Sinn (1990). We regressed the change $\Delta(NEA/GDP)=(NEA/GDP)_{1987}-(NEA/GDP)_{1970}$ on RGDPCHG between 1970 and 1987:

$$\Delta(\text{NEA}/\text{GDP}) = -0.45 + 0.0038 \text{RGDPCHG}, \quad (6)$$

(-7.42) (4.10)

where R^2 is 0.13, and the number of observations is 111.

3.5. Convergence of NEA

This section examines the dependence of the change in NEA/GDP between 1970 and 1987 on the initial NEA/GDP level. The NEA/GDP values are taken from Sinn (1990). There exists only a very weak tendency (or practically no tendency) for β convergence:

$$\Delta(\text{NEA}/\text{GDP}) = -0.32 - 0.09 (\text{NEA}/\text{GDP})_{1970} \quad (7)$$

(-5.70) (-0.71)

where R^2 is 0.00, and the number of observations is 111. The average of NEA/GDP in 1970 is -0.14 , and the standard deviation equals 0.39. The average of NEA/GDP in 1987 is -0.44 , and the standard deviation is 0.65. The standard deviation increased substantially between 1970 and 1987; there is a strong tendency towards σ divergence.

4. Conclusion

This paper considers some static and dynamic aspects of net external assets (NEA). NEA/GSP is negatively related to output per capita for U.S. states. On the other hand, NEA/GDP is positively related to output per capita for countries. This is an expected outcome if we assume that individuals have Stone-Geary preferences. Very poor countries tend to be net debtors because they try to avoid extremely low values of consumption. This phenomenon does not occur among U.S. states where consumption is well above its subsistence level. (Another explanation for this observation is that people in poor countries are myopic.) Moreover, for U.S. states there is typically no significant relationship between NEA/GSP and SPI per capita.

The growth of NEA is negatively related to the growth of output per capita for U.S. states (as expected theoretically) and positively related to the growth of real output per capita for countries. For U.S. states, the growth of NEA is also negatively related to the growth of SPI per capita. It is plausible that capital flows within the U.S. are **efficient**; physical capital flows to places with a rapid technological change (and high rates of return on capital). On the other hand, it is likely that international capital flows were **inefficient**; capital inflows were connected with a below-average output performance.

For U.S. states, NEA depends always positively on total output, but this dependence is not significant. For countries this dependence is always positive and significant in some cases. The absolute value of NEA depends negatively on total output both for U.S. states and countries. This observation is consistent with the notion that large economies are less open to international capital flows. For U.S. states this dependence is typically insignificant. For countries this dependence is typically significant, especially if output enters the regression in its logarithm.

There exists a strong tendency for σ convergence and β convergence of NEA/GSP for U.S. states in the 1977-1992 period. There exists a strong tendency for σ divergence and a very weak tendency for β convergence of NEA/GDP for countries in the 1970-1987 period.

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