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**Infrastructure Capital and Economic
Growth: The Long Term Mexican
Experience**

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Abstract

This Working Paper analyses the development of infrastructure capital in Mexico for the period 1935-1989, its relationship with economic growth, institutional evolution, and its role in the economic policy and strategy. It is shown here that in a long term perspective, both infrastructure and directly productive capital accounted for complementarity, therefore supporting a long-term strategy by the unfolding of externalities.

This paper investigates the long term relationship between growth potential and economic infrastructure divided in sub-periods of infrastructure implementation. The first sub-period covers 1935-1954, defined as one of process of intensive capital formation, which although targeted at counteracting external shocks, resulted in a remarkable stability of infrastructure policy implementation. In an attempt to determine the time sequence of Mexican growth, a case of development via excessive capacity of infrastructure was detected to be present until 1945, turning into another of development via shortage infrastructure capacity from then onwards. By the second period covering 1954-1970, termed as one of macroeconomic stability and relative abandonment of infrastructure, produced positive effects on the whole economy rather from infrastructure capital (assets) than from infrastructure investment (flows), by realising the under-utilised output-capacity induced by infrastructure. From 1970 macroeconomic instability resulted also in an unbalanced infrastructure policy and a considerable contraction of investment, biased towards petroleum which came to an end as part of the structural reconfiguration of the economy, leading to the privatisation of these assets from 1989.

Resumen

En este documento de trabajo se analiza el desarrollo del capital de infraestructura en México en el periodo de 1935 y 1989, y su relación con el crecimiento económico, evolución institucional, así como su papel en las políticas y estrategias económicas. Se muestra aquí que en una perspectiva de largo plazo, el capital infraestructural y no infraestructural fueron complementarios, contribuyendo conjuntamente a una estrategia de largo plazo que generó una serie de externalidades positivas al aparato económico.

Se investiga también la relación de largo plazo entre crecimiento económico potencial y la infraestructura económica, dividida de acuerdo con subperiodos de aplicación de política infraestructural. El primer subperiodo cubre los años de 1935 -1954, definido como el del proceso de formación intensiva de capital, que si bien buscó contrarrestar los efectos de choques

externos, resultó en una aplicación de estos recursos sumamente estable. El segundo periodo, 1954-1970, es identificado como uno de estabilidad macroeconómica y de abandono relativo de la infraestructura, en el que los efectos positivos sobre la economía resultaron más bien del (acervo) capital de infraestructura que de sus inversiones (flujo), al materializar la capacidad instalada sub-utilizada. La inestabilidad macroeconómica registrada desde 1970 resultó también una política de infraestructura desequilibrada y una considerable contracción de sus inversiones, con un fuerte sesgo hacia la industria del petróleo. Este subperiodo concluyó con la reconfiguración estructural que en materia de infraestructura inició en 1989, con la privatización de dichos activos.

Introduction

*'The infrastructure is a reflection of our social and historical evolution. It is a symbol of what we are collectively, and its forms and functions sharpen our understanding of the similarities and differences among regions, groups and cultures...Reflecting on the history of human endeavour, we are impressed by the creative achievements expressed through the arts, and engineering and science. The infrastructure is a dramatic statement that embodies all of these aspects. Many of the most esteemed, valued, and visible achievements of mankind have been in the domain of infrastructure: the watercourses and gardens of Babylon, the lighthouse at Alexandria, the roads and aqueducts of the Romans, the Suez and Panama canals.'*¹

1. Infrastructure: A Conceptual Framework

The focal point of this paper is infrastructure: the built environment in which social relationships and economic processes take place. The term covers all the logistic displays of an economy and is ordinarily preceded by a national macroeconomic strategy. In part, the infrastructure is designed to overcome the uneven distribution of natural resources, enabling human beings to extend the range and control over their lives. Finally, it occupies a position at the forefront of the notion of economic growth, quality of life, and development.²

In recent years, there has been a renewed interest in investigating the relationship between growth potential and economic infrastructure. Economists' attention shifted to infrastructure in order to provide a possible explanation for the productivity downturn that some countries have experienced since the mid-1970's, where a major role is attributed to the decline of public capital applied to social overhead capital investment, maintenance and repair. In the 1980's public infrastructure investment was neglected in the midst of the wave of privatisations, deregulation and reorganisation of financial markets, which paved the way for private sector's direct participation in the provision of such services.

¹ Herman, R., and J. H. Ausebel, *Cities and Infrastructure: Synthesis and Perspectives*, in J. H. Ausebel and R. Herman (Ed.), *Cities and Their Vital Systems. Infrastructure: Past, Present and Future* (Washington, DC, 1988), p. 1.

² For the rest of this study, the term 'infrastructure' will be employed analogously to economic or social overhead capital. Although strictly speaking the expressions 'built environment' and 'man-made environment' may include a wider range of immobile capital assets such as houses, offices, shops, factories, warehouses, highways, airports, dams, etc., many authors in the specialised literature use them to denote the economic infrastructure, and so will they be used here.

Clearly, there is now a need to reconsider the question of infrastructure within economics and economic development. It is not simply the case that previous debates need to be updated; rather infrastructure has remained largely neglected in the economic debate, even though it is a central issue.

Before reviewing the theoretical issues and empirical evidence, an overview of the underlying concepts, properties and characteristics of social overhead capital will prove to be useful.

2. On the Definition of Infrastructure

It has been acknowledged that 'infrastructure is easier to recognise than to define'.³ Although there is not a widely accepted definition for research purposes, dictionaries ascribe the meaning as 'the underlying foundation or basic framework of a system or organisation'.⁴ For the purposes of the present study it is considered as the relative large physical capital facilities and organisational frameworks that are fundamental to the working of society and its economic development. An alternative 'reduced form' describes infrastructure as 'the collective and integrative capital basis for economic activity'.⁵

Infrastructure can be disaggregated into social and economic, however this boundary is not easy to draw. A functional distinction is helpful to set apart the social from the economic role of built environment: whether it is employed to facilitate the undertaking of productive processes or to directly deliver services to final consumers, thus enhancing their quality of life and welfare. One of the problems in differentiating infrastructure emerges from the fact that, either social or economic, the components of infrastructure are highly heterogeneous and are capable of serving both functions at the same time. Some elements of 'social' infrastructure (such as education and training) are no less important than economic infrastructure for the purposes of efficiency and international competitiveness. The common characteristic they share is that both yield services, which are consumed by all economic agents in a relevant geographical area. This research is concerned to analyse those categories which can be

³ Kay, J., Efficiency and Private Capital in the Provision of Infrastructure, in OECD (ed.) Infrastructure Policies for the 1990's. Forum for the Future Conference. (Paris, 1993), p. 55

⁴ Longman Dictionary of English Language. (London, 1984), p. 755.

⁵ Definition advanced by Derek Diamond and Nigel Spence in the study commissioned by the British Department of Trade and Industry, where they investigate the impact of local and regional infrastructure on the cost structure, competitiveness, productivity, income, and employment. Although this is a micro and regional analysis, the conceptual advantages of this definition can be exploited for aggregated macroeconomic analysis, as it considers the elements of infrastructure that cause the enhancement of productive potentiality, and consequently of economic growth on a national basis. On a macroeconomic approach, Michael Todaro constructs his growth model employing a similar description of such type of investment 'which facilitates and integrates economic activities.' Diamond, D., and N. Spence, Infrastructure and Industrial Costs in British Industry. (London, 1989), p. 49. Todaro, Michael, Economic Development, 7th edition, 2000, p. 100.

considered as supportive of directly productive activities: these are: transportation (roads, railways, waterways, airports, harbours); communications (telephones, post and telegraphs); and public utilities (electricity networks, power stations, oil pipelines, oil refineries, gas network water and sewage). Two reasons support this emphasis. In the first place, the underlying theoretical approach relies heavily on the contribution of infrastructure to productivity. The second reason emerges from the literature, which indicates that many of the other infrastructure categories reflect more effects on consumption, rather than on production⁶. Thus, consumption of services such as health, culture, education, is more closely related to a broader field of study that exceeds the present one, integral development.

For theoretical abstraction purposes, infrastructure is treated as a homogeneous capital good. However, it is not, and it can be reasonably expected that its services will generate a range of outcomes with respect to economic development. What this group of facilities have in common is that they are elements of an integrated system or network.⁷

It is a *potentiality factor*. 'The basic proposition is that there is a special group of resources characterised by high degrees of 'publicness' that determines potential income, productivity, and employment. This group of resources comprises infrastructure and, in addition geographical location, agglomeration, and sectoral structure'.⁸

The facilitating capital accounts for a dual nature: it is simultaneously a public good and a capital good. By means of the *publicness criterion*, it is distinguished from private goods. As a result of the huge costs and time involved in implementing projects, band type systems (roads, railways, waterways, communication networks, energy and water supply systems) generally register greater publicness than point infrastructure (bridges, telecommunication stations and power stations). The *capitalness criterion* permits a differentiation between infrastructure and non-capital goods, and thus forms part of the production function of a region or economy. Its services

⁶ For instance, Dieter Biehl reports that the findings of his first study for the European Community are much more diffused when a broad definition of infrastructure was used, than when it was restricted to transportation, communication, energy and education, having excluded the infrastructure services of systems like those for water supply, environment conservation, health, social, cultural, sport and tourist facilities. Similarly, Aschauer found a significant positive effect on private sector growth resulting from public infrastructure, by considering highways, water and energy supply. Biehl, D., The role of infrastructure in regional development, in R. W. Vickerman (Ed.), Infrastructure and Regional Development, (London, 1991). See also Aschauer, D. A., Is public expenditure productive?, Journal of Monetary Economics, 23,2 (June, 1989), pp. 177-200.

⁷ For example, according to Tatom 'infrastructure refers to the relative large physical capital facilities and organisational knowledge and technological frameworks that are fundamental to the organisation of communities and their economic development. It includes legal, educational and public health systems; water treatment and distribution systems; garbage and sewage collection, treatment and disposal; public safety systems...; communication systems, public utilities and transportation systems.' Tatom, J. A., Is infrastructure crisis lowering the nation's productivity?, The Federal Reserve Bank of St. Louis Review, 75, 6 (November/December, 1993), p. 3.

⁸ Biehl, Dieter, The Contribution of Infrastructure to Regional Development, Final Report of the Infrastructure Study Group to the Commission of the European Communities, (Luxembourg, 1986), p. 9.

are spatially limited and exhibit virtually absolute immobility, indivisibility and non-substitutability.

3. The Economic Impact of Infrastructure Capital

Public investment in infrastructure is relevant for economic growth. Regarding its role as an input in the production process, the economic built environment has much more than a marginal effect on productive capacity. Up to a determined amount of capital, infrastructure services are a *sine qua non* for development and for the very existence of many economic activities.

It is important to distinguish the short-term ‘multiplier’ effects from the long-term effects on productivity. For the purposes of this research it is assumed that the latter is far more significant for economic growth and development, as it is in the long run that all the inputs relative utilisation may vary (even in the case of no technological progress), allowing the efficiency gains and an increased scale of operations. In order to differentiate between the short and long run effects, it is useful to separate the production phase (investment intensive) and the utilisation phase (exploitation of the productive potential of the capital asset). A distinction is made between flows and stocks: investments flows switch on the multipliers of the economy’s current activity, through the aggregate demand, while capital stocks are expected to cause productivity gains, via the enhancement of aggregate supply.

Economists had left aside infrastructure as an input in their models, to concentrate on labour, land, and capital (but only encompassing the private component or machinery). The role of the productive built environment was frequently ignored or at best, marginalised. In recent years, the infrastructure public capital stock and its importance to the economy became the subject of widespread speculation. This concern mainly emerged from David Aschauer’s work, the infrastructure-deficit hypothesis, where infrastructure enters as an input whose services enhance the productivity of both capital and labour. This way, the productive built environment becomes into another input in the production function. Such long neglected simple notion suggests it as a powerful instrument to promote economic growth and no macroeconomic studies on a similar path are known for developing countries.⁹

⁹ ‘The economy periodically produces puzzles that help to keep economists employed. One of the best full-employment puzzles of recent decades is the growth slowdown...David Aschauer has made one of the more fascinating and important contributions to this debate...Few economists are able...to shake up the profession as much as Aschauer has done.’ Aaron, H. J., Discussion, in Munnell, A. H. (ed.), *Is there a Shortfall in Public Capital Investment?*, Conference Series No. 34, Federal Reserve Bank of (Boston, 1990), p. 51.

4. Infrastructure and Development: Long Term Performance

This section's objective is to analytically overview the empirical evidence on state intervention, growth and public investment in infrastructure from 1935, in order to assess the impact of such facilitating services on the process of economic development in Mexico. The central implication is that public investment in social overhead capital had an important part to play in the development process that commenced around these years, but a role whose effects in supporting to the private capital were materialised in the form of an enhanced productive capacity of the economy, which eventually enabled the attainment of accelerated and sustained rates of output and private investment growth in the following decades. One part of the analysis covers the sub period 1935-1954, for which statistical series on public investment are available, but not so on capital assets. Thus it is not possible to measure its long term effects, which take the form of productive capacity enhancement, and rather they will be analysed the short term effects that operate through increases of the effective aggregate demand.

In order to identify the relevant subdivisions of the 1935-1985 period to be analysed, the first section provides an overview of the long-term pattern of social overhead capital formation, in the light of its relationship with economic growth. Thereafter it will be revised the changing structure of the economy from the post-revolution years, the whole 1935-1954 period, and finally its current situation by 1955, in the eve of the stabilising development strategy.

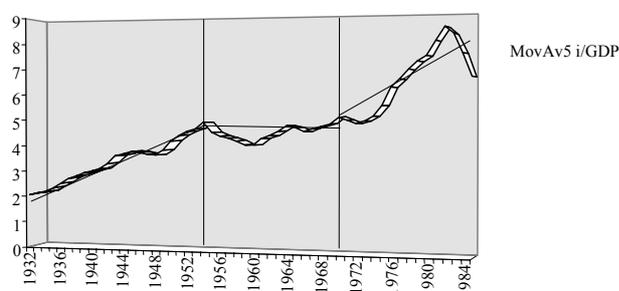
In the present research, half a century of Mexico's economic development is analysed, centring the attention on the role that public investment in infrastructure played in the process. The period 1935-1985 has been chosen given that it was then when the government was the provider of a majority of the facilitating services required by the productive apparatus and by the whole economy in general.

For analytical purposes, the series are divided into sub periods. The criterion used in identifying the relevant sub periods is threefold. Firstly, cycles and trends of the facilitating services, as well as the shifting patterns of its branches and relative weight. Secondly, attention is paid to the time sequence of infrastructure and non-infrastructure activities, according to Hirschman's conceptualisation, where the two patterns identified are development via either excessive or shortage capacity of infrastructure.¹⁰ The former is present when facilitating sector expands its capacity at such faster pace that the directly productive sector lags behind in increasing its capacity. The latter case, development via shortage capacity of facilitating capital, comes about

¹⁰ Hirschman, Albert O., *The Strategy of Economic Development*, (USA, 1958), p. 90.

when output capacity infrastructurally induced stagnates, thus leading the directly productive sector to grow more rapidly. And the third criteria used for period demarcation is the development strategy implemented by the economic authorities, that proves to be useful in distinguishing phases of overhead capital formation. Although to a lesser degree, identification and demarcation in time will pay attention to six-year presidential term (*sexenios*), which for the Mexican case shed some light for the analysis in terms of economic planning and execution.¹¹

F I G U R E 1
PUBLIC INVESTMENT IN INFRASTRUCTURE
AS PERCENTAGE OF GDP (%)



Source: Elaborated with information from Secretaría de la Presidencia, Dirección de Inversiones Públicas, *México: Inversión Pública Federal, 1925-1963*, (México, 1964), Table 5, and INEGI, *Estadísticas Históricas de México*, (México, 2a ed., 1990), Table 8.1.

Remarks: Calculations based on five year moving averages.

An overview of the Mexican economy's modern history is presented in the previous figure, where three phases can be clearly identified between facilitating services capital formation and output, based on the share of public expenditure in infrastructure on gross domestic product (I_i/Q hereafter), on a five year moving average basis.¹² Firstly, the years running from 1935 to 1954,

¹¹ Solís argues that in Mexico economic cycles coincide with the six years political calendar. Regarding public investment, '...in the first year of an administration it is planned the investment of the sexenio and, therefore, the realised expenditure is low; in the second year the administration initiates its own programme, expenditures increase rapidly and they keep more or less that level from the third to the fifth years; in order to complete the works that have been initiated it is produced a new increase during the sixth and last year.' It has been demonstrated by Fitzgerald that although this cycle may be significant in the short term, for instance for stabilisation purposes, in the long term it is balanced out. Given the long-term development approach here undertaken, the sexenio cycle is not relevant for the research purposes and it is eradicated by means of statistical transformations of the statistical series, like moving averages and logarithms. Solís, Leopoldo, *La Realidad Económica Mexicana: Retrovisión y Perspectivas*, (Mexico, 1970), p. 297. Fitzgerald, E.V.K., *Patterns of Savings and Investment in Mexico: 1939-76*, (Cambridge, 1977), Working Papers No. 30, pp. 10-11.

¹² From this moment onwards, all references to economic variables are calculated from five year moving averages, unless otherwise stated. This transformation eradicates the short-term oscillations, at the time that enables to capture and analyse in a more comprehensive form the long-term trends and patterns of the variables under scrutiny.

when the (Ii/Q) coefficient not only grew at the fastest pace ever recorded in the country's modern economic history, as the steep slope shows, but also did it in a very stable manner. During these years deviations with respect to its trend are very low. (Ii/Q) passed from 1.8 percent in 1929 to 4.9 percent by 1954, the end of this first identified sub period. Such increase came as a result of the intense public investment programme, mostly devoted to the reposition of assets, to compensation payments for the expropriation of some industries, and to develop new assets, like those for the emerging industrial projects. This way investment grew almost twice as fast as output and in addition faster than non-infrastructure investment, resulting in a development pattern via excessive capacity of infrastructure for the years 1935-1945, which clearly indicates the magnitude of the capitalisation effort undertaken during this sub period whose resulting assets would play a key role in the process of accelerated growth of upcoming phases. This trend reverted after 1946, thus leaving for the rest of the sub period rather a development via shortage capacity.

This first sub period, 1935-1954, also witnessed the commencement and easy phase of import-substitution strategy and coincided with the intensification of public investment, which grew almost uninterruptedly until the mid-1950's. The regimes focused on developing the basic economic infrastructure needed by the economy, namely roads, electricity and irrigation.

By the second identified phase, 1955-1969, both the trend of the ratio (Ii/Q) and its degree of stability would show a different behaviour. Although its average (4.5 percent) was higher than that recorded in the previous stage (3.7 percent), it never exceeded the height of 4.9 percent registered in 1953-1954 and even declined during the first six years of this sub period. Such trend came as a result of the behaviour of both components that integrate the (Ii/Q), that is, on one side the growth of investment decelerated to 7.3 percent, and on the other side national output's growth speeded up to reach an average rate of 6.7.

T A B L E 1
OUTPUT AND INFRASTRUCTURE INVESTMENT
(ANNUAL AVERAGE GROWTH RATE)

PERIOD	INFRASTRUCTURE INVESTMENT (A)	GDP (B)	(A)/(B)
1935-1954	9.4	5.3	1.77
1955-1969	7.3	6.7	1.09
1970-1985	9.0	5.7	1.58

Source: Elaborated with information from Secretaría de la Presidencia, México: Inversión Pública, Table 5, and Inegi, Estadísticas Históricas, Table 8.1.

Remarks: Calculations based on five year moving averages.

As the previous table shows, such redirecting trends of GDP and social overhead capital formation may be taken as a first indication that the economic activity must have taken advantage of the intensive capitalisation that occurred in previous sub periods, thus accounting for a pattern of development via shortage capacity of infrastructure for the whole period. The years 1955-1969 cover the stabilising development strategy, characterised by the intensification of the import-substitution strategy in a context of faster economic growth, low inflation, and from 1956, fixed exchange rate. Although from 1960 social overhead capital formation recovered an increasing trend, what marks the difference in the post-1970 period is its oscillating behaviour. Even though (I/Q) fell within the boundaries of 4.1-4.9 percent, fluctuations around its mean were relatively large, as it is indicated by the area above and below the average of phase II in the figure. The branches with an outstanding investment performance were rather supportive for the industry, like electricity, petroleum, steel, and air transportation, at the time that in contrast resources applied to railways even decreased.

The coming to an end of the stabilising development strategy inaugurated the third sub period (1970-1985), characterised by high but erratic economic growth, this time accompanied by high inflation, balance of payments unbalances, and consequently, devaluations. The expansion of state participation in the economic arena led public investment to grow 9.0 percent per year, again with an erratic behaviour, being resources mostly spent on the branches of petroleum, electricity, air transport, telecommunications, and agriculture. At the same time that public investment accounted for a diminishing participation in total public expenditure, more importantly for this study's purpose is the fact that government's economic overhead capital also showed a decreasing share in total public investment, further reinforcing the pattern of development via shortage capacity found from 1945 for the first sub period and for the whole 1955-1969 period. Larger amounts of resources were devoted year by year to administrative objectives, which would eventually limit the productive capacity expansion and productivity enhancement, let alone the associated problems on inflation of this kind of expenditure.

In September 1982 the banking system nationalisation represented the zenith of interventionism in Mexico and also marked the inflection point of a long-term development strategy that lasted more than fifty years, where economic overhead capital was almost solely provided by the state. Clearly, the privatisation programme implemented from 1985 opened for the private sector the domain of infrastructure in most of its branches, like steel, highways, railways, telephones, and petrochemical, among others. Although not to be privatised, some others departments account for private capital participation, for instance in the form of: private funding schemes, like the electricity generation; joint ventures, as in the case of petroleum; and others remain under government's ownership, but being operated under concessions by the

private sector, like highways. It is from 1985 that government investment is certainly not the only, and perhaps not even the most important, determinant of facilitating industries services provision. The implementation of a neo-classical economic strategy has led to the reduction of public enterprises (*empresas paraestatales*) from 1155 in 1982 to less than two hundred by the mid-1990's. Thus, at the present moment the picture of infrastructure assets ownership is quite distant from being a definitive one.

4.1 *Infrastructure and Development, 1935-1954: The Process of Intensive Capital Formation*

In the beginning of the 1930's, when the import-substitution strategy was deliberately launched in Mexico, a new scheme was being implemented where domestic resources would be mobilised much more intensely than ever in the past.¹³ Facilitating services would be central for the efficient performance of the whole economy, in contrast to the outward looking strategy of the *porfiriato*, where infrastructure development got concentrated mainly in the linking of railways, seaports and the northern border, with the few important consumption and production centres. This time in contrast, all sectors would actively participate and their linkages with the whole society would be felt more strongly.

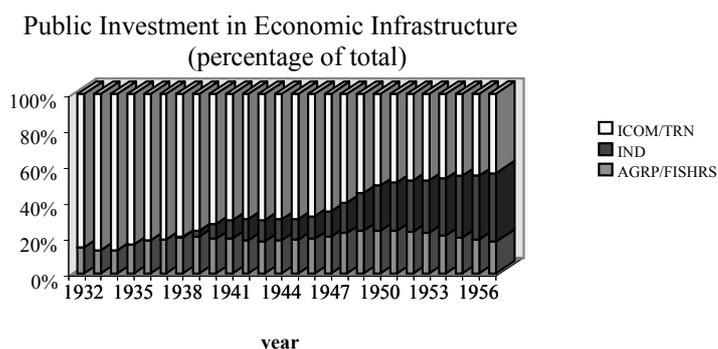
Public investment in economic overhead capital increased six fold from 1935 to 1954. However, such expansion was not felt homogeneously across all branches, each one rather reflecting the regime's conception of the development strategy to be undertaken. So far, infrastructure has been employed as a concept that consolidates a group of sectors, which provide supportive services to direct productive activities like agriculture, manufacturing, the whole industry, services, and others. These concerned activities are called infrastructure sectors and it is aimed at demonstrating here that they were central elements in the design and implementation of this period's sectorial economic policy. It will also be seen that its performance was not limited to overcome the economy's bottlenecks at both microeconomic and regional levels. Furthermore, it was conceived, designed and implemented to support development from a long-term perspective, by means of stimulating the expansion of output capacity of the whole economy.

Figure 2 illustrates the sector composition of infrastructure public investment. The bottom of the columns show how resources devoted to primary activities closely fluctuated around the 20 percent level throughout the whole period. There, it is made clear that a more changing situation took place in the

¹³ 'Undoubtedly, the 1930's meant a radical change in the structure of the economy, in the economic policy and, in general, in the role that the state started to play in the economic development of the country. Cárdenas, Enrique, *La Hacienda Pública y la Política Económica, 1929-1958*, (Mexico, 1994), p. 70.

other two sub sectors, industry and communications and transports. By the beginning of the period public resources spent on communications and transports represented more than four fifths of the total, at a time when none were applied to industrial facilitating services. It was not but until the late nineteen thirties, at the time of the oil industry nationalisation and the creation of the *Comisión Federal de Electricidad*, that fiscal funds destined for industry appeared in official budgets and by 1954 it represented one third of total. It can be clearly seen that the development of energy and other industrial outlays relied on the diminishing resource allocation for the communications and transports sector as a proportion of total infrastructure investment, although all 3 branches continued to grow, both in real terms and as a percentage of GDP.

F I G U R E 2



Source: Elaborated with information from Secretaría de la Presidencia, *México: Inversión Pública*, cuadro 5.
Remarks: Calculations based on 5 year moving averages.

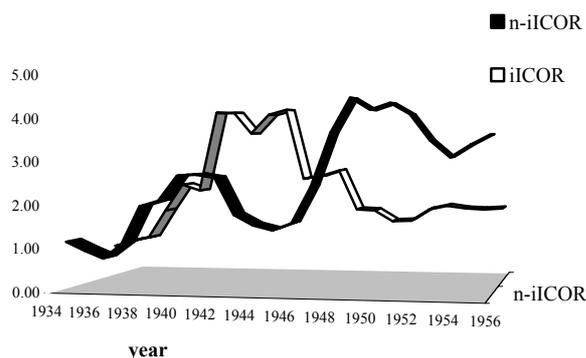
4.1.1 A Comment On The ICOR and The Impact Index

Along this section, it has been found a pronounced and fairly constant drive of infrastructure capitalisation of the Mexican economy, so much for public and private components. War had brought about some negative effects on capital formation, mostly affecting to the private side, thus allowing economic overhead capital to move ahead also of the accelerating GDP. At this point the application of indicators like the capital-output ratio (henceforth the COR) to infrastructure may shed some additional light on such development relationship. The average capital-output ratio of an economy is the stock of capital divided by the annual flow of output (K/Q), while the incremental capital-output ratio (ICOR hereafter) measures the relation between increments

to the capital stock, or investment, and increases in output ($\Delta K/\Delta Q$, or alternatively $I/\Delta Q$). When the economy grows steadily, close to its full capacity, ICOR resembles to the average COR¹⁴. Given the limitations on capital assets information for this period, the rest of the section will use ICOR.

In general it was a period of smooth growth, even in the presence of severe external shocks and internal economic structural changes. iCOR's fluctuations indicate the extent of uncertainties that operate in the system in realising output from the investments that are made in different years. In the particular case of overhead capital, they are particularly indicative of the lumpiness of investments taking place in some years with relatively low troughs in some other years.¹⁵ For the long-term development purposes of this research, ICOR based upon the data of five-year averages of original values seem to give more sensible results, than those based on the original data.

F I G U R E 3
ICOR OF INFRASTRUCTURE AND NON-INFRASTRUCTURE SECTORS



Source: Elaborated with information from NAFINSA, *La Economía Mexicana en Cifras*, (México, 1978), Cuadro 2.5, and Secretaría de la Presidencia, *México: Inversión Pública*, Table 5.

Remarks: Calculations based on 5 year moving averages.

The whole economy's output capacity was jointly enhanced by infrastructure and non-infrastructure capitalisation. The previous figure shows that the former component registered a full cycle from 1935 to the mid-1945, having reached

¹⁴ Thirlwall, A. P, *Growth and Development, with Special Reference to Developing Economies*, (London, 5th ed., 1994), p. 114.

¹⁵ Panchamukhi, V. R., *Capital Formation and Output in the Third World*, (New Delhi, 1986), p. 43.

its height (4.3) in 1944, with an iICOR of 3.8 during the War years.¹⁶ iICOR calculations for non-infrastructure activities from 1948 onwards indicate that in a more favourable economic environment both domestic and international, these activities were able to take advantage of infrastructure services, whose iICOR declined, thus showing a more intense utilisation of its capacity, and consequently with a larger efficiency.

While the global (iICOR) moved steadily overtime, sector and intra-sector evolution was far from being homogeneous, as the electricity's ratio increased uniformly from nil in the first three years of the period to 13.3 in 1954, in contrast to the whole industrial sector that scored an average of 0.3. Evidently the industry took advantage not only of productivity gains from its own capitalisation, but also from its strong intra-sector linkages and from the positive externalities provoked by other infrastructure activities, like communications and transports, whose (iICOR) was the highest among sub sectors, 13.9 as an average of the period. In addition, industrial (iICOR) was strongly favoured by the official trade policy, which besides aiming to counteract balance of payments disequilibria, contributed to foster the development of domestic industries by means of protectionism.¹⁷ While in this case low iICOR derived from high growth rates of both investment and output, agriculture's low ratio (1.2) resulted from reasons related to the nature of the activity. Besides the fact that by 1935 many of the previously realised investments were possibly having outcomes, Mexico was a country with such capital scarcity in the rural sector that production must have increased considerably by means of well-projected small amounts of investments.¹⁸

Next, attention will focus on constructing an index of the impact of economic overhead capital (ϕ), as follows

$$\Pi = (\Delta Q_i / I_i) - (\Delta Q_{\text{non-i}} / I_{\text{non-i}}) \quad (1)$$

where (Π) may be rationalised as an indicator of the productivity gap between infrastructure and non-infrastructure sectors, (ΔQ) is output growth, (I) is investment, (i) denotes the infrastructure sector, and (non-i) the directly productive activities sector.¹⁹

¹⁶ A statistical outlier was found in 1953 when output stagnated and infrastructure investment maintained its pace, reaching (iICOR) a disproportionate level of 57.0. In order to avoid distortions in the five-year moving averages series here employed, the effect of this outlier has been statistically eradicated.

¹⁷ Méndez Villarreal, *La Relación Capital-Producto*, p. 68.

¹⁸ Himes, James R., 'La Formación de Capital en Mexico', in Solis, L. (Ed.), *La Economía Mexicana. Política y Desarrollo*, (Mexico, 2a. Ed., 1978), p. 173.

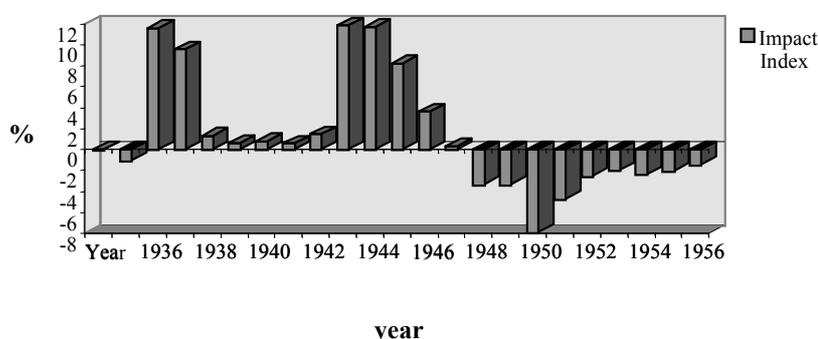
¹⁹ The investment productivity gap and impact index were developed by Ohkawa. Domoto reports having also applied it to the Japanese case. Ohkawa, Kazushi and Hirohisa Kohama, *Lectures on Developing Economies*, (Tokyo,

Now, the impact index (ϕ) is specified as

$$\phi = \Pi (I_i / I_{non-i}) \quad (2)$$

which is illustrated in the following figure.

F I G U R E 4
IMPACT INDEX OF INFRASTRUCTURE INVESTMENT ON NON-ACTIVITIES (PERCENTAGE)



Source: Elaborated with information from NAFINSA, *La Economía Mexicana en Cifras*, (México, 1978), cuadro 2.5, and Secretaría de la Presidencia, *México: Inversión Pública*, table 5.
 Remarks: Calculations based on 5 year moving averages.

The previous figure shows that prior to 1947, the infrastructure sector's production accounted for a greater impact from its own investments than the rest of the economy, which reverted from then onwards. This fact must not be taken in terms that there were no benefits for non-infrastructure activities, as obviously there were, but rather as that from 1947 onwards the creation of facilitating outlays accounted for impacts on the whole productive apparatus that were stronger than those on the same infrastructure sector. Once again this one is an indication that contributions to development not only materialised, but also were economically efficient in the sense that public investments in infrastructure echoed in larger output returns.

During the period 1935-1954, the Mexican economy experienced an expanding effect poured out by the intensive application of official resources on economic overhead capital development, which turned not only into expanded private investment, but also of the whole economy productivity. A major fraction of output multiplication must have come through a succession of short-term effects, driven by the aggregate demand. Once more it is said that

1989), Lecture 5. Domoto, Kenji, *Infrastructure Investment: Its Impact on Economic Development of Japan During 1885-1940*, (Tokyo, 1992), pp. 11-14.

the development effects of infrastructure are expected to arise more perceptibly from the capital assets or aggregate supply enhancement. Such measurement of separated short and long-term effects will be a central task in the next two sections, for the corresponding periods for which capital stocks statistical series are available.

In the present section, a series of infrastructure capital-output ratio based indicators have confirmed both the enhancement of the economy's productive capacity by means of economic overhead capitalisation, and the commencement of non-infrastructure capital exploitation of the already mature outlays. This way, it was set up the context for the Mexican economy to move to more advanced phases of development, namely the period corresponding to the stabilising development.

4.2 Infrastructure and Development, 1954-1970: Growth, Macroeconomic Stability, and the Relative Abandonment of Infrastructure

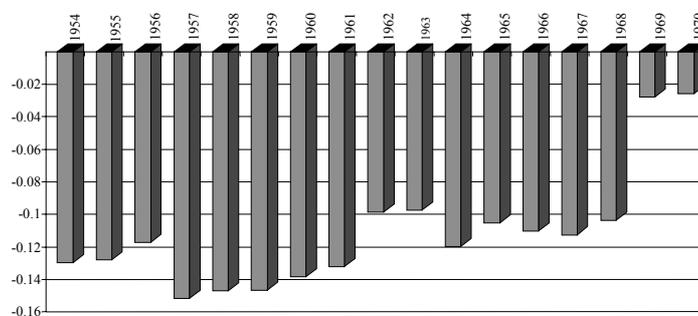
Based on the decomposition of the changes of sectoral ICOR, both infrastructural and non-infrastructural, inferences on structural transformations and on resources efficiency have been derived. For instance, if 'in any given period the sectoral composition of output changes in such a way that sectors with relatively higher capital output ratios such as power, railways, heavy industries, etc., assume a dominant position and also if at the same time sectoral capital-output ratios do not change, then increase in the aggregate capital-output ratios cannot be taken as a reflection of a fall in the efficiency of the investment resources of the economy.'²⁰ Obviously, to the extent that the aggregate ICOR changes as a result of shifts in the sectoral composition of output, inferences cannot be drawn on the efficiency in resource use from the changes in capital-output ratios.

The indirect effects of infrastructure investment, derived by means of the methodology previously derived, are shown in the following figure.

²⁰ Panchamukhi, V.R., *Capital Formation and Output in the Third World*, (New Delhi, 1986), p.13.

F I G U R E 5

IMPACT INDEX OF INFRASTRUCTURE INVESTMENT ON NON-INFRASTRUCTURE ACTIVITIES (%)



Source: Elaborated with information from Presidencia, *Inversión Pública Federal, 1925-1963*, table 12. Presidencia, *Inversión Pública Federal, 1965-1970*, table 16, and Banco de México, *Cuentas Nacionales*, table 130.
Remarks: Calculations based on five year moving averages.

This figure illustrates that services offered by the economic built environment to the overall productive apparatus. The ascending movement indicates that during the years of the *economic miracle* years, although infrastructure capitalisation lost grounds against the rest of the economy, its services contributed in expanding directly productive activities. In other words, in spite of the diminishing (Ii) and augmenting (Inon-i), the effect of the services provided by infrastructure capital assets was so strong that in the formula, it counteracted the lower infrastructure capitalisation. Two noticeable declines may be pointed out, in 1956, as well as in 1962-1963. In both cases, it was a result of the coincidence of a fall of (Ii), an increase of (Inon-i), and a strong expansion of output, once the economic measures started to generate a marked expansion of the economic activity.

However, in general the slope of the impact index was upward, indicating a more intense utilisation of infrastructurally induced output capacity. Thus, the development effects of infrastructure arose more perceptibly from capital assets, than from the short-term effect induced by investment through the aggregate demand. This way it is very much called into question the *miraculous* character of the stabilising development strategy.

4.3 Infrastructure and Development, 1970-1989: *Instable and Imbalanced Capitalisation*

This paper research has attempted so far to place in a historical perspective the evolution of the Mexican economy, stressing specially the importance of infrastructure. The present section analyses the process of social overhead

capitalisation and its contribution to output growth in the period running from 1970 to 1988. These years were characterised by the sharpest oscillations ever of the main indicators in the Mexican economic history, which was also reflected on the productive apparatus infrastructure.

The working hypothesis in the present section is that the characteristics adopted by the development of the productive built environment in Mexico, form a series of problems that made growth highly volatile and finally constrained it. These problems were counteracted to a certain extent by the large amount of external resources flowing into the economy from 1970 to 1981, derived from foreign borrowing and oil exports, thus enabling a fast but unbalanced growth. From 1982 onwards, the weight of the external debt and the over-reliance on a single primary product whose international price declined markedly, clearly demonstrated the non-sustainability of the dynamism based on exogenous factors.

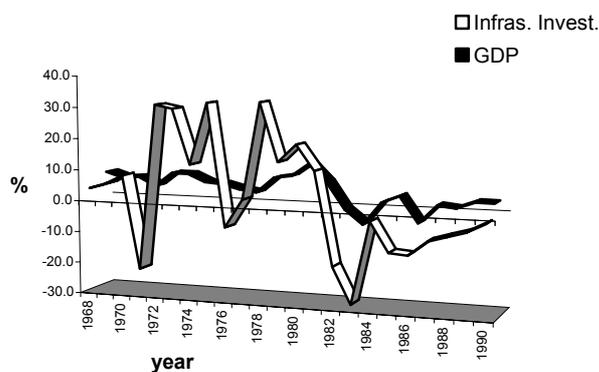
The first objective in this section is to study the interaction between infrastructure investment, capital and growth is studied in section 6.3. The inconsistent behaviour of social overhead capital formation contributed to the erratic evolution of growth. This reveals the relatively weak linkages prevailing between the oil producing sector and other sectors, which biased the economic activity in favour of a single and relatively isolated sector and against a major number of sectors.

Finally, it will be demonstrated that notwithstanding that the strategies implemented were neither stable nor balanced, the expanded productive built environment contributed importantly to enhance the output capacity. By doing so, it is confirmed that Mexico missed a historical opportunity to undertake a strong drive towards infrastructure capitalisation, which emerged from the relative abundance of resources. Therefore, although the country ended up with a greater productive capacity, it lacked balance among sectors, and more clearly between directly and indirectly productive capital.

5. The Dynamics of the Economy

In the period 1970-1989 output increased at an average annual rate of 4.0 percent, 6.7 percent in 1970-1981 and 0.3 percent in 1982-1989. On its side, the expansion of state participation in the economic arena led infrastructure investment to increase to an average of 2.2 percent per year, 13.3 and -10.5 percent in each sub-period. Such an erratic behaviour overtime, reflected at both global and sectors levels, was the distinctive feature of this period.

F I G U R E 6
GROSS DOMESTIC PRODUCT AND INFRASTRUCTURES INVESTMENT VARIATION



Source: Elaborated with information from Secretaría de la Presidencia, *México: Inversión Pública Federal 1965-1970*, (México, 1970), cuadro 12; Secretaría de la Presidencia, *México: Inversión Pública Federal 1971-1976*, (México, 1976), cuadro 14, and INEGI, INEGI, *Estadísticas Históricas de México*, (México, 3rd edition, 1994), table 8.1.

According to the evolution of output and infrastructure capitalisation, the period 1970-1988 is further divided into three sub-periods. The first from 1970 to 1979, of rapid growth and erratically ascending investment, both total and in infrastructure. The second from 1980 to 1981, when the accumulated effects of the oil boom triggered the most impressive expansion of both variables ever in the economic history of Mexico. And finally, the 1982-1989 years of crisis and transition from an extremely interventionist scheme to a liberalised one, accompanied by a decline in rates of growth and an even more dramatic fall in the rate of infrastructural capitalisation.

5.1 Expansionism and Instability: 1970-1977

In the first sub-period, corresponding to the years 1970-1977, the economy enjoyed an accelerating rate of expansion, equal to 5.8 percent per year, but the low inflation rates registered in the last fifteen years were no longer present, giving pace to increasingly accelerated rates of growth of prices.

In 1970, and more clearly by 1971, Mexico was experiencing a crisis influenced by short-term causes, like the recession of the international economy. However, other causes of a structural nature were also present, like the exhaustion of the infrastructurally induced output capacity after the long period of neglecting that it had just gone through. The main causes identified in the literature are referred to the insufficient development the internal

market to generate a self-sustained process of growth, the external and fiscal unbalances, the slower technological progress, and the resulting decline in productivity growth, among others. For example, about the main causes of the early 1970's crisis, Solís asserts that the import-substitution strategy and its protectionist policy left to the domestic market the role of the engine of growth. Its insufficient capacity for job creation and its clear tendency towards the external unbalance, along with a rising fiscal deficit, jointly constricted growth, because the former debilitated to the domestic market, and the latter because the trend of the economy towards acceleration induced imports increases that fostered the trade deficit.²¹ Bazdresch and Levy argue that the 'stabilizing development brought about sustained growth, but a gamut of structural problems lurked behind the screen of price and exchange rate stability: agricultural stagnation, inward biased industrialisation, regional disparities and urban bias, and insufficient attention to income distribution and poverty. The strategy generated growth, but at increasingly higher costs.'²² On its part, Huerta identifies the origins of the growth slowdown in the loss of dynamism of technological progress, which led to a declining productivity growth, and therefore of the manufacturing production.²³

Despite that the ratio of infrastructure to output (i/Q) passed through a long period of neglect and never got to break its 1950 all time high level, 5.6 percent, but until 1975, the productive built environment was not given any consideration in the literature as a cause behind the growth slowdown of the late 1960's. Gerardo M. Bueno not only does not consider the neglect of infrastructure capitalisation as an important cause for the increasing economic problems. He even argues that in addition to the accelerated population growth and the inadequate transference of technological progress, the stabilising development problems were associated to the generalised propensity to confer greater more importance to the problems associated with the creation of physical infrastructure (roads, communications, bridges, etc.) than to those related to human resources infrastructure (food, public health, education, popular housing, science and technology, etc.).²⁴

The first visible signs of such crisis were, on the one hand, the emergence of strong inflationary pressures after a prolonged cycle of price stability, and on the other hand, the contraction of the private investment. This way the signs of

²¹ Solís, Leopoldo, 'Comportamiento de la economía mexicana a partir de 1910: Fases y características', in México: Setenta y Cinco Años de Revolución. Desarrollo Económico, (México, 1988), p. 881.

²² Bazdresch, Carlos and Santiago Levy, 'Populism and economic policy in Mexico, 1970-1982', in Dornbusch, Rudiger, and Sebastian Edwards (editors), The Macroeconomics of Populism in Latin America, (Chicago, 1991), p. 234.

²³ Huerta G., Arturo, Economía Mexicana, Más Allá del Milagro, (México, 1991), pp. 41 and 42.

²⁴ Bueno, Gerardo M., 'Las estrategias del desarrollo estabilizador y del desarrollo compartido', in Bueno, Gerardo M. (coordinador), Opciones de Política Económica en México Después de la Devaluación, (México, 1977), p. 30.

success of the stabilising development disappeared and they came to the surface those of the deterioration.²⁵

In an attempt to recover the dynamism of the previous years, the new government applied an orthodox stabilisation programme, aiming at a recovery from the next year onwards. The growth of output decelerated from a 7.0 percent average in the 1960's to 4.1 percent in 1971. The central element of the government's initial strategy was a clear deceleration of its expenditure and investment in 1971 (4.9 and 4.6 percent, respectively). Social overhead capitalisation accounted for a more noticeable slowdown (3.4 percent), which marked the culmination of the negative trend in the state's interventionism, initiated in the 1940's, where public expenditure specialised in the creation of infrastructure. It was the reflection of a state participating less and less as a direct impeller and guide of development, and acting more and more as an indirect promoter of economic activities, both national and foreign.²⁶

The private sector had been constitutionally excluded from participating in the infrastructure sector: the government was the only one entitled to invest in the *strategic sectors* of the economy.²⁷ Besides, these sectors counted on very low profitability. Therefore, it was decided that this role of the government would be invigorated, in order to avoid bottlenecks, which eventually could restrain growth. Policymakers of the era increased public investment, for two purposes: social overhead capital, aiming at fostering private investment and the overall economic activity; and or the creation and enlargement of the public enterprises apparatus, operating in non-infrastructure activities where the private sector's participation was feasible.

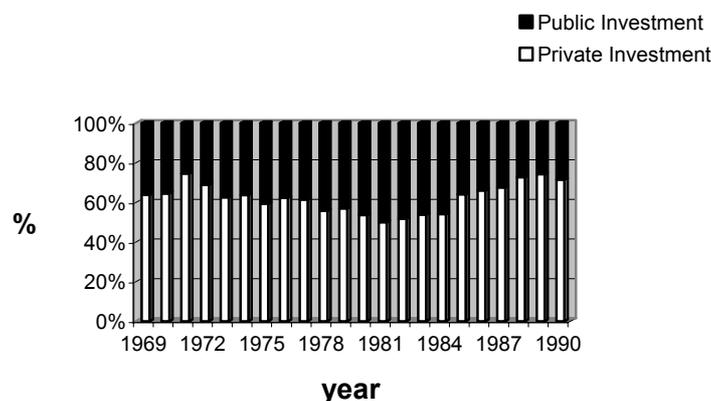
This way the infrastructure policy entered into a 'stop and go' phase which, for reasons explained below, would continue for the rest of the period covered by this section.

²⁵ Ayala, José, José Blanco, Rolando Cordera, Guillermo Knochenhauer, and Armando Labra, 'La crisis económica: evolución y perspectivas', in González Casanova, Pablo and Enrique Florescano (coordinadores), México, Hoy, (México, 1979), p. 48.

²⁶ Velasco Fernández, Ciro, 'El gasto público de los setenta', in Investigación Económica, Vol. XXXVIII (1979) No. 150, p. 432.

²⁷ According to the 28th Article of the Mexican Constitution, the strategic areas comprise: mail; telegraphs; satellite telecommunications; railways; electricity; oil; nuclear energy generation; radioactive minerals; currency minting and money issuing through a single bank, among other. However, as reviewed there, this article has been subject to ambiguous legal interpretations in the practice, and more noticeably, to many amendments overtime. Constitución Política de los Estados Unidos Mexicanos, Artículo 28, (México, 1983), p. 28.

F I G U R E 7
PUBLIC AND PRIVATE INVESTMENT
% OF TOTAL



Source: Elaborated with information from Secretaría de la Presidencia, *México: Inversión Pública Federal 1965-1970*, (México, 1970), cuadro 12; Secretaría de la Presidencia, *México: Inversión Pública Federal 1971-1976*, (México, 1976), cuadro 14, and INEGI, INEGI, *Estadísticas Históricas de México*, (México, 3rd edition, 1994), table 8.1.

From 1972 onwards the government performed a more active role in growth promotion, by means of a much more intense utilisation of its policy instruments and of a grater involvement in all productive areas, therefore increasing its occupancy of the economic panorama.

Based on the assumption that an aggressive expenditure policy was needed in order to simultaneously recover growth, to compensate the agriculture sector's decline that had commenced in the previous decade, to absorb the growing number of unemployed and new workers entering to the labour market, and to progress in the field of income re-distribution. Total public expenditures increased yearly 13.2 percent on average during these seven years, from a level of 24.6 percent of GDP in 1970 to 39.5 percent in 1977.

At the same time, infrastructure investment accounted for a diminishing participation in total public expenditure. For the objectives of this research, it is important to stress the fact that while economic overhead capitalisation's annual increase was 7.9 percent between 1970 and 1977, its participation in total public investment increased from 68.7 percent in 1970 to 77.6 percent in 1977, a level not registered since the pre-1960 years.

However, the average growth of infrastructure investment does not reveal its instability over the years. Every time the economy had to be cooled down either when facing high inflation rates, external sector's bottlenecks, or when structural changes were introduced, the adjustment was strong and negatively felt on investment, and more strikingly on social overhead capital. In the case of the first sub-period, for 1971, 1973-1974, and 1977, fluctuations of all

variables were pronounced, yet the sharpest ones were to be found in the facilitating industries investment. It is clear that its objectives were of a short-term macroeconomic character, aimed at influencing the business cycle and at compensating the also irregular and lean private investment.²⁸ Clearly, in spite of the expansion of infrastructurally induced output capacity, due to economic and political reasons it was easier for policymakers to postpone, to cut indefinitely, and even to abandon investment projects, than reducing wages, introducing job cuts to bureaucracy, or to eliminate subsidies and transferences to social groups. This behaviour was not exclusive of the 1970-1977 years, but prevailed during the whole 1970-1989 period.

Stability in the process of capitalisation investment was previously, as a key feature for a sound infrastructure policy. Sub-optimal enhancement of the productive capacity induced by the facilitating sector was also identified as one of its negative outcomes. Although beyond the scope of the present research, it is relevant to point out an additional harmful effect derived from such neglect, which a sort of time bottleneck was resulting from the unfeasibility to match in time both the aggregate demand and supply. Another characteristic previously identified was the long-term maturation period of overhead capital outlays. Thus, by trying to rapidly expand the productive capacity in booming years, through sudden and massive injections of resources, the 'stop and go policy' would eventually yield an enhanced capacity, in the medium or long term. Nonetheless, strong pressures would be excerpted on the aggregate demand in the short term. Therefore, it is worth stressing that inflation, the problem that was being attacked by means of policies that reduced the economic activity, was also reinforced when cutting infrastructure investment that exposed the aggregate supply to greater bottlenecks, therefore inducing faster inflation rates in the coming years. This way, intuitively it is possible to infer the existence of a sort of inflation component induced by the lack of sufficient and timely productive overhead capital.

As said, all of the public expenditure components accounted for important expansions, although clearly current expenditure grew faster than capital expenditure, as a result of the government's decision to directly create jobs, which necessarily led to increase the number of bureaucrats and departments of the public administration apparatus.²⁹ In the pre-1970 years, the public enterprises had been established to add to the private investment and to maintain the employment levels, while their objective in the post-1970 years would become to contribute to accelerate the process of private capital

²⁸ Velasco Fernández, Ciro, 'El gasto público de los setenta', in *Investigación Económica*, Vol. XXXVIII (1979) No. 150, pp. 437 and 438.

²⁹ In 1970, the public employees were below 15 percent of the national labour force, while in 1983 the figure increased to 18.8 percent, reaching its peak level in 1987 at a 20.0 percent level. On its side, the number of public enterprises or *empresas paraestatales* augmented from 354 in 1970, to 854 in 1976, and finally to 1155 in 1982, after the nationalisation of the banking system.

accumulation, by way of subsidies.³⁰ According to Gil Diaz, had the price policy for goods and services provided by the government not been applied that steadily, which at the same time was proudly hoisted like one of the pillars of the stabilising development, they would have been mitigated a major number of the economic problems in the 1980's.³¹ This way, an important proportion of public resources was applied in the dominion of infrastructure, although not for its enhancement, but in the form of subsidies.³²

On the other hand, as the government was neither able to improve the tax collection system, nor to adjust in real terms the prices of the goods and services it produced, public incomes eroded progressively. This situation, combined with the expenditures increase, led the fiscal deficit from 2.2 percent of GDP in 1972, the year of the induced recession, to a peak of 8.7 percent in 1975. From 1976, this negative balance declined to reach in 1979 a level of 6.3 percent, after the stabilisation programme agreed with the International Monetary Fund.

Beyond economic trends and derived from the intensification of the state's management, this subperiod has been frequently invoked in the specialised literature as a textbook example of the effects of the political calendar on the Mexican business cycle of the whole economy, and more clearly on public investment and expenditure.³³ Perhaps as never before, the political calendar –*sexenios*– marked the conduction of the economy. In a similar vein, the behaviour of social overhead capitalisation also accounted for a high correlation with the political cycle in these years, displaying in broad terms the following pattern. Infrastructure investment would decline in the first year of the presidential administration, 'as the new team states its economic objectives and consolidates the operational mechanisms to spend in certain projects'.³⁴ Afterwards, investment would increase and remain at a relatively stable level in the intermediate years, especially when inflation and the current account turned not into major problems. The final two years of the presidential administrations were characterised by tremendous expansions of both, total

³⁰ Marúm, Espinoza, Elia, 'Intervencionismo estatal y transformaciones del sector empresa pública en México', in *El Nuevo Estado Mexicano. Estado y Economía*, Tomo I, (México, 1992), p. 207.

³¹ Gil Diaz, 'El camino de México', pp. 313-314.

³² According to calculations presented by Rizzo on the importance of subsidy granted by the public sector in the form of low prices for domestic energy, a heavily infrastructure-capital supported service, in 1973 its world price was 29 percent above the domestic price. Weighted by its domestic consumption volume, the subsidy represented 0.8 percent of GDP. By 1979, after the series of shocks in the international market, such disparity reached 306 percent, whereas resources devoted to subsidise its consumption in the national market reached 7.4 percent of GDP, a figure comparable to the overall fiscal deficit that year. Rizzo, Socrates, 'Excedentes económicos e instrumentos de política: perspectivas hacia la década de los 80's', *Comercio y Desarrollo*, (México, 1980), quoted in Hierro, Jorge, and Allen Sanginés, 'Public sector behaviour in Mexico', in Larraín, Felipe, and Marcelo Selowsky, *The Public Sector and The Latin American Crisis*, (San Francisco, 1991), p. 152.

³³ For instance, see Fitzgerald, E. V. K., *Patterns of Savings and Investment in Mexico: 1939-76*, Working Papers No. 30, (Cambridge, 1977), pp. 10 and 11; Hierro, and Sanginés, 'Public sector behaviour', p. 152; and also Solis, *La Realidad Económica*, p. 297.

³⁴ Hierro and Sanginés, 'Public sector behaviour', p. 155.

public and infrastructure investment, fostered by the goal of finishing the projects initiated in the previous four years.

In general terms, the private component also followed closely this guideline, as it was closely linked to public investment, due to the weight of the government in the economy. An ambitious industrialisation programme launched by the government led public investment, and specially that on infrastructure, to grow fast in this sub-period. The industrial sector accounted for half the total resources invested in the productive built environment. There, steel industry turned out to be the main beneficiary of this strong drive for capitalisation, as its investment accounted for a growing participation, passing from 3.7 percent in 1970 to 15.2 percent in 1975. This extraordinary expansion was concentrated in a single steel-making project, the most important individual project ever undertaken in México. Certainly the steel-making complex *Lázaro Cárdenas-Las Truchas* accounted for a significant impact on the productive apparatus. However, its weight would not be perceived but until after 1976, when it generated important revenues by selling every year to the national and international markets more than 1.5 million tons of steel. In the short term, the project meant a disbursement of approximately one billion USA dollars, including the industrial and seaports infrastructure of the region.³⁵ In 1978, the government established a public steel-making holding *Siderúrgica Mexicana, S.A. (SIDERMEX)*, aiming at controlling and co-ordinating the development of the three most important public enterprises in this field: *Altos Hornos de México, S. A.*, *Siderúrgica Lázaro Cárdenas-Las Truchas, S. A.*, and *Fundidora de Monterrey*, which altogether were in charge of 81 percent of the liquid steel installed capacity in 1976.³⁶ It has been previously said that the lack of stability in the long-term investment was a feature present throughout the period, therefore limiting the promotion of collateral investments and growth effects. In agreement with Cypher, this was the only one project pursued with any sense of consistent deliberation, but 'some of the major steel projects started during this period were only completed in the late 1980s. The steel-making program was beset with a multiplicity of problems that undercut much of its ability to stimulate the economy.'³⁷

On its part, the energy sector was to become the leading sector of the economy in the post-1976 years. However, from 1970 to 1977 the resources devoted to electricity, oil and gas production remained at a level close to 48 percent. An expansive programme for the oil industry was launched in 1972 and led to the discovery in 1976 of huge oil and natural gas reserves.³⁸ It enabled

³⁵ Rivera Ríos, Miguel Angel, and Pedro Gómez Sánchez, *Acumulación de Capital y Crisis en México*, (México, 1986), pp. 51 and 52.

³⁶ Secretaría de Programación y Presupuesto, *El Papel del Sector Público en la Economía Mexicana*, (México, 1980), p. 31.

³⁷ Cypher, James M., *State and Capital*, p. 95.

³⁸ As an explanation of the fivefold increase of the foreign public external between 1970-1976, Maddison states that 'it must be surmised that Echeverría knew that Mexico was sitting on, and about to discover for commercial purposes,

the self-sufficiency that the country had not met before, but more importantly, the future excess production devoted for exports which generated impressive amounts of foreign exchange, in the absence of agriculture as the leading sector of the economy. This way the industrialisation drive was eventually made possible, as well as the implementation of an aggressive policy, at the time that the exchange rate was kept at its 1954 level.

The need to reinvigorate the primary sector led to a policy of government assistance, at a moment when agriculture showed strong rigidities and inflexibility to increase the production of food, raw materials, and to produce the surplus for export. The *Programa de Inversiones Públicas para el Desarrollo Rural (PIDER)* was launched in 1974 as a mechanism to develop infrastructure works, mainly based on the indigenous labour force to create new sources of employment through the exploitation of new plots of land and the improvement of the existing ones, as well as the establishment of agro-industries and handicrafts centres.³⁹ As a whole, the primary sector's investment increased its participation from 19.6 to 23.9 percent from 1970 to 1977. In spite of this effort for the sector's capitalisation, it was incapable to revert the decline of its contribution to GDP, falling from 11.6 percent to 9.7, after the long neglected capitalisation of the stabilising development.

In the 1970-1977 subperiod, the transports sector's participation also kept on declining in global infrastructure investment. It partly came as result of the relatively more advanced phase of development that the economy was going through, where other kinds of industrial overhead capital was required by the productive apparatus.⁴⁰ A sort of neglect of resources also applied to this important sector which, although relatively advanced in terms of linking the main production centres of the country, was still in the need of investments for the road, railways, air and sea ports system enhancement and maintenance. Having hoarded more than four fifths of total resources in the 1920's and

huge oil and natural gas reserves, so that he was able to gamble on a heavy inflow of foreign exchange in the latter half of his administration.' Reasons rather political were advanced by Story, who argues that the Echeverristas viewed increased exports as a policy that squandered Mexican resources in order to satiate the energy appetite of other nations, and they were extremely apprehensive of U. S. intentions and feared direct pressure from Washington if the optimistic projections of Mexican petroleum were publicised. Also, the Echeverría team preferred a nationalistic and conservationist ethic of keeping the oil and gas in the ground in order to save it for future needs. Story also speculates that 'the expansion-oriented technocrats within PEMEX wanted to hide the true potential of the oil wealth even from Echeverría for fear that he would use it irresponsibly'. Maddison, Angus, and Associates, *The Political Economy of Poverty, Equity, and Growth: Brazil and Mexico*, (New York, 1992), p. 133. Story, Dale, *Industry, The State, and Public Policy in Mexico*, (México, 1986), p. 165.

³⁹ Ayala Espino, *Estado y Desarrollo. La Formación de la Economía Mixta Mexicana, (1920-1982)*, (México, 1988), pp. 440 and 441.

⁴⁰ In the study for the Japanese case, Domoto confirmed that approximately half of the resources in the facilitating industries went to transports and private railway in the initial years, 1887-1912, declining afterwards to less than twenty percent by the mid-1930's. At the beginning of the economic development of Japan, 'indispensable were transportation and private railways. These two sectors continued to share a substantial part of facilitating industries. Especially investment in private railway at the initial aspect of development seems to have played an important role in supplying transportation service to economic society during the relevant period.' Domoto, Kenji, *Infrastructure Investment: Its Impact on Economic Development of Japan During 1885-1940*, (Tokyo, 1992), p. 8.

1930's, it just reached 28.7 percent in 1970 and 16.5 percent in 1977. After an precipitous impulse from 1972 to 1975, its historically observed declining trend took it to account for just for 12.6 percent in 1979.

The communications sub-sector, in need of much improvement, benefited from a burst of resources, represented by a 37.2 percent annual average growth in 1970-1977. As a result of its heavy reliance on imports, it accounted for a relatively restricted contribution to output. This way, its corresponding GDP increased at a less impressive rate equal to 14.5 percent. On this respect, as Cypher has asserted 'the state made a wise choice. Yet many components and parts had to be imported because industry was largely restricted in terms of its abilities to producing household electrical appliances. Had the state invested in the creation of a telecommunications *industry* in tandem with its investments in the *products* of this industry, an important stimulus to the economy could have been created.'⁴¹

5.2 *The Oil Boom: 1978-1981*

The second sub-period, 1978-1981, displayed the most impressive economic expansion witnessed in the Mexican economic history, fostered by foreign resources incomes from both, the oil exports and the intensification of external indebtedness. The 8.4 percent average growth of real GDP yielded a per capita GDP that increased at an annual rate hardly ever registered, 5.4 percent. The private sector shared this ebullience fostered by the extraordinary public expenditure, allowing to the private and total investment to peak. Infrastructure followed closely the same course. In 1978-81 it expanded 19.7 percent, reaching in 1981 an all time high proportion of GDP equal to 8.8 percent, twice as much as that registered during 1970-1972. In this strong drive for capitalisation, the industry's infrastructure was the main beneficiary, growing at a 26.0 percent annual average rate, in contrast to 9.2 and 14.2 percent corresponding to the primary and to the communications and transports sectors.

It was clear that the energy sector was the engine of the industrialisation programme. Consequently PEMEX, the public oil monopoly, absorbed more than one third of total infrastructure investments, while C.F.E., its counterpart in the electricity sector utilised more than one sixth of resources. The strong growth of overhead investment for electricity generation, transmission and distribution, 17.6 percent as annual average, brought important effects. In the same period, the sectoral GDP increased annually 10.1 percent. However, its contribution to the economic apparatus was more important in terms of the

⁴¹ Cypher, *State and Capital*, p. 95.

service it delivered to the rest of the sectors, let alone the effect of subsidies of this service on consumption.⁴²

Strengthening the infrastructure for the exploitation of oil resources was crucial to the economic strategy, therefore its investment increased threefold. Actually, and in contrast to the general assumption, 'the oil bonanza of the 1970s and 1980s was not a gift of God but the result of an enormous investment effort.'⁴³ In general terms, it would not be accurate to characterise the Mexican experience like a case of *petrolización* as in other countries, but rather of a strong external reliance on oil, as it was indeed employed as an instrument to adjust the external deficit and to foster growth.⁴⁴ Effectively, the sector performed a multiple role in the overall economic evolution. Firstly, it contributed by financially supporting the continuation of the subsidies for capital accumulation. Secondly, it provided the foreign currency that enabled the imports expansion. Thirdly, it served as the guarantee to access to foreign borrowing. And finally, the oil-producing sector performed the role of the productive apparatus's engine and stimulated to a limited group of sectors with strong linkages, like steelmaking, machinery, equipment, and construction.⁴⁵

This sudden injection of resources brought about strong effects on the rest of the economy which, however strong, were not sound for infrastructure long-term purposes. In the context of a 'stop and go' policy, where decisions were hurried and improvisation in the design and application of government programmes tended to prevail, in such way that part of the efficiency of public investment was lost. There was, too, administrative confusion and corruption.⁴⁶

For its part, the private sector invested important amounts of resources to expand the productive capacity of the internal market, which was growing along with the oil-producing sector. According to Cárdenas, it was clear that as had previously happened with silver in the colonial period, exports of a single

⁴² In contrast to the experience of other countries, in Mexico the consumption of electricity increased and speeded up between 1973 and 1981, as a result of its declining price in real terms. A study based on the correlations of the demand of electricity confirmed this relationship, where the price elasticity turned out to be negative (-0.79). Pedrero Nieto, Rafael, 'Visión económica del sector eléctrico', in Reséndiz-Núñez, Daniel (coordinador), *El Sector Eléctrico de México*, pp. 321-323.

⁴³ Maddison, Angus, and Associates, *The Political Economy of Poverty, Equity, and Growth: Brazil and Mexico*, (New York, 1992), p. 177.

⁴⁴ This semantic debate between *petrolización* and *petrodependencia* is elucidated by the examples of countries falling in the first category, like Venezuela and the Arab countries, where roughly half of their GDP was delivered by the oil producing sector. In México oil just represented 7 percent of GDP, but the clear signs of oil reliance simultaneously took the form of: mono-exports, as oil represented two thirds of the exports of goods; international financial mono-dependency, as 50 percent of foreign incomes were built by oil exports; and fiscal mono-dependency, as the relative contribution of PEMEX constituted 25 percent of total fiscal incomes. Villarreal, René, 'De la industrialización sustitutiva a la petrodependencia externa y de sustitución de importaciones', in González M., Héctor E., *El Sistema Económico Mexicano. Un Análisis Sobre su Situación Actual*, (México, 1982), pp. 34 and 35.

⁴⁵ Rivera Ríos, Miguel Angel, and Pedro Gómez Sánchez, *Acumulación de Capital y Crisis en México*, (México, 1986), p. 71.

⁴⁶ Ayala, 'La crisis económica', p. 57.

product were promoting growth and development.⁴⁷ However, the limited linkages of this sector with the rest of the economy were not overcome. Throughout the oil boom, México continued to be a mere producer of basic oil products, with a low domestic value-added content. According to Cypher, investment in petroleum refining would have been necessary, but some of this capital would have come from *reducing* outlays for exploration. 'The benefit of the shift would have been twofold. Mexico could have raised the value of its exports with a lower level of crude production (thus saving on imported drilling technology while maintaining greater longevity in the oil fields) and reduced imports of a range of petroleum based products (plastics, paints, synthetic fibers, and so on) by vigorously stimulating import substitution in upstream production of petroleum based products. This action might have been accompanied by a new aggressiveness in creating parastate firms in industrial branches using highly refined petroleum-based products.'⁴⁸

The 14.2 percent average increase of the communications and transports sector's overhead capital was also remarkably unbalanced within sub-sectors. It was mainly composed by the behaviour of two branches, air transport infrastructure, that on average grew at an impressive rate equal to 44.2 percent, and pipelines, that passed from a zero investment to represent 29.6 percent of the communications and transports sub-sector's overhead capital formation. Branches growing below the sector average were air, railways, roads, and telecommunications (10.3, 8.8, 2.4, and -3.6 percent, respectively).

The participation of agriculture in the economy continued to decline, both in terms of its demand for infrastructure and share of GDP. Over the four years its output expansion (1.5 percent, annually), led in 1981 its participation in total infrastructure investment and GDP to further descended to 10.1 and 5.2 percent, respectively.

Over the whole period starting in 1935, public investment in infrastructure for water irrigation had accounted for very high productivity, when a growing proportion of resources applied for its enhancement was accompanied by similar trends of the primary sector's output and productivity. However, the judgement of public officials and academics was that in the 1970's what the Mexican agriculture was in the need for was of wealth and income redistributing measures, rather than of the enhancement of its economic infrastructure.⁴⁹ This way, between 1970 and 1981 irrigation systems' capital

⁴⁷ It is stressed by Cárdenas that an advantage of this period's experience was that, in contrast to the previous episode, this time oil was owned by Mexicans, specifically by the government, therefore in principle the Mexican people was more likely to get benefited. Cárdenas, 'Los problemas económicos contemporáneos', p. 28.

⁴⁸ Cypher, James M., *State and Capital in Mexico: Development Policy Since 1940*, (Boulder, 1990), p. 110

⁴⁹ In the academic sphere, Rodríguez Cisneros asserted that the main problem of the agriculture was not found on the side of production supply, as in 1980 Mexico counted on enough social overhead capital, as well as on the institutions and human resources to avoid future hunger crisis. Rather, the general problem of the sector was found in the need to achieve a better income distribution in the sector. In the outline of a new agrarian policy, Warman pointed at the fundamental problem of providing a productive occupation with a fair remuneration for the rural workers. Clearly, these statements disregarded taking into consideration a key element to explain and counteract the primary sector's

accumulation virtually remained at the same level, in contrast to other components like investments *for rural development*, aiming at re-distributing wealth in the rural sector through health and education enhancement, but which at the same time lacked of the sort of effects on productivity investigated in the present study. This way, as a continuation of the *Programa Integral de Desarrollo Rural* launched in 1973, the *Sistema Alimentario Mexicano* was introduced in 1980 in search of reactivating the sector and so meeting the self-sufficiency of the country's food needs. In that context, there was a continued shift away from a long term strategy based on the intensive capitalisation of the rural sector, to one based on a rather sort term approach through the increase of the *precios de garantía* and the provision of seeds and fertilisers at subsidised prices.

As previously described, important amounts of resources were put to use for infrastructure capital assets formation from 1970 to 1981, although in an unbalanced way. However, these growing amounts that succeeded in switching on the economic machinery at very dynamic levels, at the same time failed to do so in a stable way, in preventing the emergence of internal bottlenecks, and in constructing an economy strong enough to resist external shocks. This policy also fell short of promoting growth in a sound manner, in the sense that the effects and by-products of its application would not risk the enhanced output capacity, like in the case of the inflation originated by the escalating fiscal deficit. Certainly the contributions of infrastructure to the expansion of the output capacity would not be immediately noticed, thus creating temporary bottlenecks, but what contributed most to hinder such beneficial outcomes was its extremely variable pattern of application.

5.3 *Crisis and Structural Change: 1982-1989*

The internal absorption of the effects of the decline of oil prices and the increase in interest rates in the international markets, took the form in 1982 of a strong recession, when real per capita GDP fell 3.1 percent, inflation rate soared, and the balance of payments deficit caused a 600 percent devaluation of the peso.

The transition from an extremely interventionist scheme to a rather liberal one took place from 1983 and extended beyond the coverage of the present research. The structural change programme included a strong reduction of public expenditure, both current and for investment, the deregulation of the economic activity, the selling or closing of public enterprises, and in general, a

deterioration, the striking relative decline accounted by resources devoted for infrastructure in the past two decades. Rodríguez Cisneros, Manuel, 'Agricultura y ganadería', in Instituto de Investigaciones Sociales de la UNAM, *El Perfil de México en 1980*, (México, 8a. edición, 1979), p. 7. Warman, Arturo, 'El problema del campo', in González, Casanova, and Enrique Florescano (coordinadores), *México, Hoy*, (México, 1979), pp. 119 and 120.

turn from the inward-looking model of development (undertaken by the country in the past decades) to outward-looking oriented growth. There, infrastructure capitalisation was proposed to be carried out also by the private sector, having previously been supplied exclusively by the government.

The 1982 crisis resulted in a dramatic decline in the ratio of infrastructure investment to GDP ratio, from a peak of 8.40 percent in 1981 to 7.04 percent in 1982. Although the privatisation programme did not reach the infrastructure sector but until 1989, the effects of the political calendar on investments was reinforced by the financial crisis that the economy was going through. In addition, once again the 1982 experience confirmed that it was easier for the policymakers to postpone or even to cut expenditures in social overhead capital, than introducing adjustments on politically and socially more sensible disbursement, like wages of public officials, subsidies of basic goods, or the number of jobs. For the rest of the years until 1989, the ratio of infrastructure investment to output (i/GDP) continued to decrease steadily, to represent just 3.1 percent at the end of the period under scrutiny. Some branches of overhead capital registered an even more dramatic decline in 1982, like agriculture (-25.9 percent). In the midst of a severe crisis and lack of financial resources, even the energy sector declined (16.1 percent). The only sector to remain virtually at the same level of 1981 was communications and transports (0.8 percent).

The structural change programme started in 1983.⁵⁰ There, the new strategy outlined the aim of recovering the dynamism of the economy, once again in a context of price stability, but this time the retreat of the state was taken further than during the stabilising development years.

For the purpose of social overhead capitalisation, neither the post-1982 years turned to be beneficial. Firstly, as a result of the economic and financial crisis, the resources previously applied to build the productive environment were diverted towards different purposes, namely to service the foreign debt. Afterwards, the whole country embarked on a process of structural change, where the economic, social and political spheres experienced the most important transformations of the post-revolutionary years. Infrastructure was not isolated from such transformation. While the government supplied more than 90% percent of facilitating services to the productive apparatus and to the society in general, in an attempt to recover the stability and dynamism of the pre-1960's capitalisation, a privatisation programme was launched in 1983, which as previously examined, would not reach this sector until the end of the decade.

⁵⁰ Under the Plan Nacional de Desarrollo, 1983-1988, after the stabilisation of the economy, a structural change programme would be launched. It aimed at overcoming the insufficiencies and fundamental disequilibria of the economy. Secretaría de Programación y Presupuesto, Plan Nacional de Desarrollo, 1983-1988, (México, 1983), pp. 126 and 127.

Although in the medium- and long-term, positive outcomes are expected from the opening of the sector to private investment, until the end of the period here under revision, 1989, it continued to represent either a 'stop and go' policy, or insufficient resource allocation. A feature of infrastructure here brought to mind again is its long maturation period. Thus, even the best possible scenarios for the post-1988 years, of important investments made either by the private or the public sectors, would not contribute to expand in the near future the infrastructurally induced output capacity of the Mexican economy, let alone the augmented problems from the insufficient planning that might result from the lack of a long term strategy and co-ordination between both.

6. The Relationship between Infrastructure and Output Expansion

The 1970's decade initiated with an impressive expansion of both capital assets and the rate of accumulation. Gross capital formation increased 14.4 percent, 15.1 percent in net terms, followed by decelerations in the next four years. On its part, gross and net investment expanded 45.6 and 76.0 percent, respectively, and falling to 10.1 and 24.1 in 1971, 5.5 and 1.4 in 1972, and to 1.4 and 13.0 in 1973. Such irregular behaviour is representative of the patterns to be observed for the rest of the period 1970-1989, where although due to different causes, instability and sectoral imbalance prevailed in the economic activity.

However irregularly investment was distributed among sub-sectors, it consistently grew at speedier rates than output. As a whole, the Mexican economy experienced an outburst of infrastructural and non-infrastructural capital growth that contributed to expanding the economic apparatus potential.

Before continuing analysing the results of these calculations on actual and potential output, it is important to make a pause to deliberate on a series of important issues implicit in the analytical tools here applied.

6.1 Theoretical Deliberations

The calculation of the index of potential output illustrated here is based on the capitalisation experienced by the Mexican economy, in both infrastructure and non-infrastructure branches. In other words, the picture of the productive apparatus potentiality is constructed by means of the expansion of machinery,

equipment, and social overhead capital, altogether, assuming the unrestricted availability of the labour input.

This last assumption has been commonly employed in the literature on growth for Mexico and other developing countries and rests on empirical evidence.⁵¹ The grounds for such assumption is based on the quantitative abundance of labour force, either unemployed, under-employed, or feasible to enter to the different segments of the labour market. An additional element, is the high degree of mobility shown by workers of developing countries from one sector or geographical region to another. For instance, during the phases when the economy took advantage more intensely of the agricultural sector, the indigenous labour force did not exhibit high mobility, whilst during the industrialisation drive carried out from the mid-1950's, the policies favoured, and actually induced, an important migration wave from the rural areas to the cities that constituted the main industrial centres.⁵²

Another important assumption adopted when building the potential-actual output index, definitely central to this research's objective of analysing the relationship between economic growth and social overhead capital, is that the productivity of capital is implicitly taken as constant for the period 1970-1989. It has been mentioned before on this thesis that, to a great extent, the developed countries' declining productivity ignited the debate on the role of infrastructure.

According to Gramlich, macroeconomists long felt that the stock of public capital was an important factor input in the production of total output. Macroeconomists had also known that U.S.A. productivity growth slowed down dramatically in about 1973 and macroeconomists should have known that investment in public capital had been down since the late 1960's. Yet analysts completely ignored infrastructure investment for the first fifteen years of this slowdown and the public capital stock was hardly ever even mentioned as a potential factor in the descending productivity. Aschauer changed all that when putting these two movements together, both in the U.S. and in some other developed countries.⁵³ When analysing the experience of the OECD countries, Shigehara suggests that the source of the post-1973 productivity slowdown is multiple, and identifies a weaker private capital formation, the retrenchment of public infrastructure, inflation, and adds human capital and political stability

⁵¹ For instance, Kindleberger and Herrick state that 'While physical capital is sometimes considered the scarcest input to development in poor countries, labor is equally frequently named as the most plentiful factor. It is common to think of low-income countries as being capital-poor and labor rich. This factor-proportion relationship has tended to manifest itself in widespread unemployment in the urban areas and underemployment in the rural.' Kindleberger, Charles P., and Bruce Herrick, *Economic Development*, (Tokyo, 1977), p. 97.

⁵² As stated by Ward, the industrialisation drive carried out from 1940 to 1970 was importantly fostered by the state's investment on basic industries, and afterwards on infrastructure. Other types of intervention by the state were also important and helpful for fostering migration from the rural areas to the cities: enough to offer cheap labour force to the cities. Ward, Peter, *Políticas de Bienestar Social en México, 1970-1989*, (México, 1989), pp. 36-38.

⁵³ Gramlich, Edward M., 'Infrastructure investment: a review essay', *Journal of Economic Literature*, Vol. XXXII, (1994), No. 3, p. 1176.

as two factors that are far more relevant for the case of developing countries.⁵⁴ The case of the United States of America is documented by Kopcke's study which 'concludes that much of the slump in productivity and potential GNP growth resulted from the slower rate of capital accumulation.'⁵⁵

Clearly the Mexican experience regarding the evolution of capital accumulation, potential output and productivity, is quite different for the same period. As for the first two variables, in Mexico they showed the opposite behaviour with respect to that in developed countries. As reported in this section, over the same period capital accumulation registered an impressive expansion in both gross and net terms. As a consequence the potential output also had an important rise and corroborated by the empirical evidence of the corresponding actual output growth, that also stepped up. Consequently, the empirical evidence contradicts the assumption of a declining productivity for the Mexican case, and it could even be argued its ascending trend resulting from the incorporation of both, more and better-qualified labour force, and more and more modern and efficient capital and its embodied technology. Therefore, the assumption of constant or even ascending productivity in the Mexican economy holds for the 1970-1989 period.

6.2 *The Evidence on Output Dynamics*

As seen, total investment grew at an irregular although increasing pace from 1970. Output responded in a similar manner. The potential output's impressive expansion was accompanied by a similar drift of actual output from 1970 to 1974. In 1975 and 1976, with the arrival of important amounts of resources derived from oil exports and foreign borrowing, the economic apparatus expanded its potentiality in an impressive proportion, also followed by an acceleration of the economic activity, which however important, lagged behind the capitalisation process and thus led to a widening of the capacity utilisation gap. It has been previously revised the relationship empirically observed between the political calendar and the economic cycle, and this case neatly illustrates the end of the *sexenio* effects.

On the one hand, the magnification of the potential output had its origin in expanding public investment and expenditure, which stimulated the economic activity to a certain extent, but more evidently to the private investments, in a case of crowding-in effect. Consistently, infrastructure also performed an active role during these two years when a significant proportion of resources

⁵⁴ Shigehara, Kumiharu, 'Causes of declining growth in industrialised countries', in Federal Reserve Bank of Kansas City, Policies for Long Run Economic Growth, Proceedings of the Symposium Held in August, 1992, (Wyoming, USA, 1992), pp. 24-28.

⁵⁵ Kopcke, Richard W., 'Capital accumulation and potential growth', in Federal Reserve Bank of Boston, The Decline of Productivity Growth, Proceedings of the Conference Held in June, 1980, (Boston, 1980), p. 26.

was directed to building up and enhancing the potential of the oil industry, which in 1976 made use of 26.1 percent of resources devoted to this sub-sector. The expansion of the oil industry's potential generated important amounts of resources derived from its exports, thus enabling to cover the imports needs of the whole productive apparatus, besides the oil sector itself, hence activating the overall activity. However, it is worth to bring into consideration that even though investments in oil overhead capital count on the shortest maturation period among all infrastructure, its affects do not materialised immediately and this contributed to widen the gap between the potential and actual output. In addition, it can be said that the network and point infrastructure employed by the oil sector count on relatively weak linkages with other sectors of economic activity. On the other hand, the second element contributing to the growth slowdown that widened the utilisation gap was the negative expectation of economic agents with respect to a series of matters. Firstly, that the expanding economy was being fostered with increasing public expenditure. Secondly, the consequent rising inflation. And finally, the fixed parity of the exchange rate, which by 1976 had been maintained at the same level for more than twenty years.

Once a considerable proportion of investments in the oil producing industry matured and the domestic economic environment stabilised, but especially when the international scenario improved for the Mexican economy with the rise of oil prices and the even larger availability of foreign resources for borrowing, the actual output speeded up, along with the capital-based potential frontier. From 1977 to 1981 the country was buoyant and enjoyed of one of the periods of faster growth ever in its economic history. Both, the potential and actual outputs expanded steadily. On its part, the utilisation coefficient remained stable. Rather than an indication of *idleness* because the economy was working below its full capacity, intuition indicates that this utilisation gap may be the indication of a certain kind of lack of connection between the oil sector and the rest of the productive apparatus, although this last point is left to be demonstrated in another study. In any case, such relatively limited linkages of the oil sector were compensated by the government's policy that permeated the whole economy through the leakage of resources to the aggregate demand, in the form of public investment, and more clearly, expenditure.

The strategy implemented from 1970 improved the potentiality of the productive apparatus by means of enhancing the productive built environment. The result was a magnified aggregate supply that settled the foundations for the coming years growth. However, in particular from 1970 to 1981 the model was considerably based also on an intense use of aggregate demand instruments, notably public expenditure. A complex net of subsidies encouraged private consumption. It was demonstrated in a previous section of the section that the consequences of such aggregate demand supported

strategy, along with the deterioration of the international economic scenario for the country (declining prices of oil and rising interest rates, in the context of high indebtedness and reliance on imported inputs), took the form of a crisis that inevitably affected to the productive apparatus, and more clearly to its degree of utilisation.

The beginning of the crisis is illustrated by the decline of output and investment in 1982. Nevertheless, in this situation the potential output continued to grow and therefore induced a new widening of the utilisation gap. This is explained by the fact that the economic agents did not perceive immediately and accurately the magnitude of the crisis, and therefore its duration and long term consequences. Such phenomenon was perceived as a transitory slowdown of the economic activity, or according to the official rhetoric, 'a cash flow problem.'⁵⁶ The gross investment kept back in a smaller proportion than the downward adjustment of the gross domestic product, enough to compensate depreciation, and so gave place to another year of an increased output capacity. The combination of the recession and the expanded potentiality of the productive apparatus in 1982, resulted in a greater utilisation gap.

This way, the GDP virtually remained at the same level for seven years. Between 1982 and 1989, the year that marks the end of the period covered in this research, the actual output's rate of growth was 0.63 percent, mainly due to the final year's growth, 3.4 percent.⁵⁷ In the meantime, the potential output induced by the accumulation of infrastructure and non-infrastructure capital assets stretched at an also modest rate, 0.9 percent on annual average and 6.8 percent accumulated. As a result, the capacity utilisation of the Mexican economy declined steadily between 1981 and 1989.

In this context of crisis and structural change, the economic toll imposed by capital depreciation was paid in terms of a loss of the post-1982 potentiality of the economy. The gap formed by the difference between gross and net potential output, represents the magnitude of resources applied to the enhancement of the economic potentiality that were consumed to compensate the depreciation of the nation's productive assets. From 1982 to 1989 the annual depreciation represented an impressive 87.7 percent of gross capital formation, in other words, only 12.3 percent of all the resources spent on the augmentation of the potential output constituted actual contributions to the

⁵⁶ When viewed in a historical perspective, it comes amazing that the problem of a foreign debt whose annual interest payments represented almost a half of total exports in 1982, was termed by the Secretary of Finance of the time as a mere cash flow problem.

⁵⁷ The so-called lost decade is clearly illustrated by the GDP's annual average growth for the period 1981-1990, equal to 0.9 percent, but appears more dramatic for 1981-1988 when growth was virtually non-existent, with an accumulated figure of 0.4 percent.

accumulation of capital.⁵⁸ This way, the invested resources were hardly capable to sustain, and barely to augment, the production possibilities frontier of the Mexican economy.

As a result of this relative abandonment of the infrastructure capitalisation underwent in the post-1981 years, it may be expected that the Mexican economy will face important constraints in the foreseen future to go back to the accelerated and steady rates of growth registered in the past decades.

It is from 1989 that government investment certainly was not the only, and perhaps not even the most important, determinant of facilitating industries services provision. The structural change of the economy, along with the reform of the state, have resulted in that at the present moment the picture of the infrastructure sector is quite distant from being a definitive one.

⁵⁸ From 1982 to 1989 the accumulated annual depreciation amounted \$1,318,931 pesos, at constant 1980 prices, 3.6 percent of GDP, while overall gross capital accumulation (infrastructure plus non-infrastructure investments) was equal to \$1,504,368 pesos, 4.1 percent of GDP.

Conclusions

In this paper, infrastructure development in Mexico has been analysed by emphasising its relationship with economic growth, institutional evolution, and considerations of economic policy and strategy, for the period 1935-1989.

A large body of analysis was devoted to the years 1935-1954. It was found that the state's capital accumulation targeted at counteracting external shocks, besides the common objectives of aggregate demand management. Regarding aggregate supply, official resources promoted economic development by providing facilitating services for the directly productive activities, by creating institutions and later on their instruments. An inclined government investment towards the communications and transports sector helped create the atmosphere for growth. The first planning efforts emphasised the central role of the primary sector, specifically agriculture, but from the 1940's industry's position was exalted, gaining an increased share among sectors, in detriment of transports.

In an attempt to determine the time sequence of Mexican growth, a case of development via excessive capacity of infrastructure was detected to be present until 1945, turning into another of development via shortage infrastructure capacity from then onwards.

In contrast with the generalised belief that public capital formation has displaced the domestic private sector from the economic arena and more specifically regarding investment opportunities, it has been shown that in a long term perspective both accounted for complementarity. Furthermore, official resources have supported a long-term strategy through the unfolding of external economies, where particulars have executed most of directly productive activities, thus being the main beneficiaries of such services.

It was found for the years 1954-1970, roughly corresponding to the stabilising development strategy. It was found that the accelerated rates of growth that the economy registered during the stabilising development, in the context of price and financial stability, relied to a great extent on the enormous productive capacity induced by infrastructure, that the economy had accumulated in the past two decades. Effectively, the progress of the Mexican economy since 1950 can be traced back to the preceding period, when most of the essential public works that would help to integrate the national market and increase production were initiated, thus enhancing the productive potential.

The analysis stressed the fact that such potential was realised through strong non-infrastructure private investments, namely in machinery and equipment. Infrastructure services, which were supplied mainly by the government, grew at a pace that lagged far behind the rest of the capital. Fiscal policy was restricted in two ways, necessarily affecting the capital formation of infrastructure. On the one hand, government incomes revealed

high inelasticity with respect to the national product, and tended to decline overtime as a proportion of GDP, as it was an explicit objective to avoid pressures on the private sector. Besides, the price of infrastructure services were also kept very low with the dual objective of restraining inflation, and at the same time fostering industrialisation by means of subsidies. On the other hand, while investments accounted for a decreasing share in total public expenditure, resources for administration and defence increased.

This relative abandonment of economic overhead capital formation freed resources that were diverted to consumption and directly productive investment, which yielded short-term profits, at the cost of facilitating industries capitalisation. So the miraculous character of the economic policy of the time is highly disputed. In contrast to the years 1935-1954, in this period infrastructure capital assets rather than investment, more clearly produced their outcomes when its under-utilised output-capacity induced by infrastructure was more intensely exploited.

Thus, rather than witnessing a *miracle*, the period of rapid economic growth covering the mid-1950s to the end of the 1960s was nothing else but an outburst of gradually accumulated energy. Finally, it is important to stress that the economic policy of the stabilising development hindered and postponed the balancing of the latent disequilibria. The external and fiscal imbalances have been frequently investigated. Nonetheless, a central element to the economy that clearly incurred in a relative abandonment was the capitalisation of the productive environment.

From 1970 to 1989 the amount of resources applied for infrastructure investment increased by a half, having expanded fourfold between 1970 and 1981. However impressive this may appear, the policy that guided it was clearly sub-optimal, in terms of expanding the productive potential of the Mexican economy in a sound manner.

It was demonstrated that the diverse strategies implemented by the economic authorities, aiming at promoting accelerated and sustainable growth either through in the form of inward or outward looking strategies, yielded sub-optimal results for the infrastructure sector, which remained distant from the productive apparatus needs. During the expansionist periods, which were based on the extraordinary incomes generated by oil exports and foreign borrowing, the unbalanced application of resources was biased in favour of a single sector accounting for relatively weak linkages with the rest of the economy, the oil producing sector. In the recessions the investment in overhead capital suffered strong shrinkages. Thus, the former case resulted in an unbalanced expansion of facilitating industries, which certainly rendered inefficient outcomes at both micro and macro levels. Meanwhile, the latter case simply tied down the output potential of the country.

The economic strategy implemented from 1970 improved the potentiality of the productive apparatus by means of enhancing the economic built

environment. This enhanced aggregate supply came to be the foundation of the growth in the coming years. Until 1981 the model was considerably based on the intense use of aggregate demand instruments, notably public expenditure and private consumption encouraged by a complex net of subsidies. It was demonstrated in a previous section of the section that the consequences of such aggregate demand supported strategy, along with the deterioration of the international economic scenario for the country (declining prices of oil and rising interest rates, in the context of high indebtedness and reliance on imported inputs), took the form of a crisis that finally affected both the productive apparatus and its scale of utilisation. On the one hand, in the years when important sources of income were available, the government allowed the price of infrastructure services to lag far behind inflation, mainly for two reasons: to promote growth by means of subsidising the energy prices, and to repress inflation. When these income sources were exhausted, the economic authorities adjusted such prices, at times in more than threefold the current rate of inflation. The prior statement means that while the economy thrived, the price of the services provided by the facilitating industries contributed to increase the fiscal deficit, while during recessions it exerted a strong short run stagnating effect. On the other hand, it was made clear that the main cause of the increasing fiscal deficit from 1972 to 1982 was the raising public expenditure, other than infrastructural. It is worth to remark that such phenomenon worsened during the second half of each presidential administration, from 1973 to 1976 and from 1980 to 1982. Administrative expenditures increased at a much faster rate than capital formation. Actually public investment, and consequently infrastructure capitalisation, was used like an instrument for immediate fiscal adjustments every time it was needed.

Until 1982, the expansion of public expenditure came as a result of the economic authorities' concentration on generating new jobs, regardless its non-sustainability beyond the short and medium terms. Regarding the enhancement of productive capacity through investment, an important proportion of resources was routed to the leading infrastructure sector, oil, without serious considerations to the market signals, mechanisms and to inter-sector efficiency. During the oil boom, revenues generated by oil exports were applied to expand current expenditure, to increase subsidies for the whole economy as well as wages and employment in the public sector, instead of increasing significantly capital formation. Thus an aggregate demand driven pattern of growth was followed, while the productive capacity gap narrowed overtime. By the time the foreign debt turned into the country's central problem, its weight as a proportion of output capacity was a major burden that prevented the economy to continue to grow at any rate, not to mention at the pace registered in the last three decades. Thus, the economic apparatus greatly relied on the resources derived from oil exports and foreign borrowing, which contrary to the

original objectives of isolating the country away from the external shocks, left an economy even more vulnerable to the oscillations of the world markets.

Once again, the evolution from 1982 to 1989 was adverse for the development social overhead capital, and consequently for the enhancement of the productive potential. The years of structural change that closed the period here under scrutiny, accounted for a considerable contraction of infrastructure investment. One of the main lessons derived from this period's experience is that public expenditure may be one of the most effective tools of economic policy, notably when applied for long term productive purposes in a steady manner, in order to generate durable positive effects. Unfortunately, the case analysed in the present section did not meet this condition. In contrast, what was observed in this period was an increasingly activist policy that gave rise to a succession of short term expansions, of a 'stop and go' kind. The outcome was an enhanced economic capacity, but unbalanced between directly productive capital and social overhead capital. Thus, it is possible to anticipate a slower dynamism of the economy, even many years after the end of the period considered in this research, due to infrastructurally induced bottlenecks and capacity constrains of the productive apparatus. As a result of this relative abandonment of infrastructure capitalisation, it may also be expected that the Mexican economy will face important difficulties to recover the accelerated and steady growth rates registered from the late 1950's, after the enormous drive for overhead capitalisation carried out since the mid-1920's that settled the foundations for the superb economic performance of the following decades.

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