Supply, demand and economic growth in Mexico in the period 1980–2016

Marco Marquez

Abstract

Economic growth is produced by stimuli arising from supply and demand. On the supply side, growth depends on the accumulation of factors and their productivity. On the demand side, it is determined by government consumption, investment and spending and net exports. Input-output tables can be used to explain the contributions made by the growth of the components of each of the variables and to find the growth path followed by the economy. From this path it can be gauged whether the type of growth is more supply- or demand-led. This paper uses input-output tables to show that growth in Mexico has relied on more dynamic supply-side components, which is not conducive to the good performance of the economic system.

Keywords

Economic growth, economic policy, supply and demand, productivity, monetary policy, input-output analysis, Mexico

JEL classification

D24, D57, E52, O54

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I. Introduction

Different schools of economic thought have discussed the question of growth from a variety of perspectives. On the supply side, it has been explained by technological change and productivity (Jorgenson and Griliches, 1967; Solow, 1956; Romer, 1994). On the demand side, it has been explained by the circular flow model. Both Leontief (1941) and Keynes (1936) considered that this variable drove the level of output in the economy. Different growth hypotheses have been developed on the basis of the approaches of these two authors, such as those put forward from a Keynesian perspective by Harrod (1939) and Domar (1947), whose contributions were based on the assumption of an equilibrium situation. This was also the starting point of Leontief's model. In addition to determining the value of production from demand, this model asserts that the integration of production is the basis for growth. In fact, the work of identifying the key sectors in the economy rests on this pillar (Hirschman, 1958; Rasmussen, 1956; Sonis, Hewings and Guo, 2000).

This paper starts by using input-output (IO) tables to analyse the decomposition of sectoral growth. It considers the possibility of using the tenets of the neoclassical school to describe the table contents and establishing that output growth breaks down into two types of effects, the substitution effect and the income-expenditure or price-cost effect, which determine the contribution to growth of the supply side factors and the demand side components (Marquez, 2019). An IO table is composed of the matrix of transactions between branches and between these and factor suppliers, on the one hand, and purchasers of goods used in final consumption, on the other. The objectives of this article are to measure the composition of these contributions and to analyse the balance between the respective growth contributions of the factors and components concerned.

We assess the growth path and the equality of the contributions of the gross operating surplus coefficients and the inventory change coefficients together with gross capital formation, as these are accounting arrangements that can be related to saving and investment, respectively. The findings are used as a basis for explaining the bias in growth towards supply or demand in Mexico over the period 1980–2016. The article is organized into three sections. The first explains the models in the IO table and sets out the theoretical basis for assessing the contributions of the market factors and components that determine the growth path of an economy as given by its growth rate. The second section presents the context and characteristics of Mexican economic growth. This then provides the basis for expounding the hypothesis of this paper. As has been shown, the manufacturing export promotion model has resulted in internal disruption of the economic structure, in that inflows of imported intermediate inputs have increased at the expense of domestic ones (Aroche, 2006; Aroche and Marquez, 2012; Ruiz-Nápoles, 2004; Zárate and Molina, 2017). The growth of the Mexican economy has been supply-driven, and for that reason dynamic export growth has not been matched by output growth (De Souza and Gómez, 2018; Ros, 2008). Low growth continues because income account contributions on the supply side have been higher than expenditures on the demand side. In other words, it is perpetuated by the balances of the contributions of the income and expenditure coefficients of the accounts linked to the concepts of saving and investment. This is a reference to the financial balance, which in turn is equal to the combination of the trade surplus with production deficits in both the public and private sectors explained by internal structural disruption. This hypothesis is tested in the third section for the period 1980–2016. The contributions and growth paths of sectors, branches and the economy as a whole are identified in accordance with the 1980 and 2013 IO tables published by the National Institute of Statistics and Geography (INEGI), which are aggregated to 35 sectors at 2013 prices (Méndez, 2018). Lastly, some conclusions and economic policy considerations are presented.

II. The input-output table, growth and equilibrium

The construction of the IO table is based on the study of circular flow, which treats the economy as a complex system of productive agents who acquire the goods produced for the purpose of using them as inputs in their own goods production processes, while at the same time selling these goods to demanders, who in turn use them as inputs. In an open model, outputs can be used for consumption or investment, among other purposes, while producers also purchase factors, among other non-produced goods (Aroche, 2017; Aroche and Marquez, 2019). The columns of the IO matrix (1, 2, ..., n) show the value of the goods purchases by each of the producers (1, 2, ..., n) from each of the sellers (1, 2, ..., n). That is, each producer produces a homogeneous good (Leontief, 1936). Leontief's (1936) IO model takes the form of a system of equations in which the production function of the branches and the preferences of agents are givens, while the unknowns are relative prices and quantities (Miller and Blair, 2009). The IO table is based on the circular flow study, which treats the economy as a complex system of productive agents interrelated from production to consumption, or vice versa (Aroche, 2017).

In his open model, Leontief (1941) starts from the accounting equilibrium recorded for the value of production in the IO table by means of equation (1), where the column vector of the value of production (x) is equal to the inverse matrix $((I - A)^{-1})$ multiplied by the final demand vector (f). The matrix (A) of technical coefficients is produced by a transformation of the inter-industry transactions matrix (Z), which represents the proportions of inputs per unit of output. In the model, the value of production is determined by final demand, which is the component exogenous to the production structure, the latter being understood as the set of relationships between branches.

$$x = \left(I - A\right)^{-1} f \tag{1}$$

$$x' = v'\left(I - E\right)^{-1} \tag{2}$$

Equation (2) is the Ghosh (1958) model, which expresses the inverse solution in determining the value of production. According to this model, output is defined by supply, i.e. by the change in the components of value added (v'), which is expanded by the multiplier matrix $((I - E)^{-1})$ of the coefficients of delivery (E). This approach gave rise to the plausibility debate (Rose and Chen, 1991; De Mesnard, 2009; Guerra and Sancho, 2011; Oosterhaven, 2012) and even to its theoretical reinterpretation as the pricing model (Dietzenbacher, 1997; Miller and Blair, 2009). However, the nature of such models means that both are only plausible if the economy exhibits balanced growth (Aroche and Marquez, 2019).

Considering that the sum of the input and factor coefficients equals 1 in each branch of the IO table, equation (3) describes the unit of output on the side of purchases of domestic inputs $(i'Z^i)$ and imported inputs $(i'Z^m)$, and the payment of factors such as capital (k') and labour (l'), plus the net costs of State intervention, i.e. taxes minus subsidies (γ'). As Leontief (1936) pointed out, this is a homogeneous model of degree one in prices; hence it is a relative quantity model. Physical unit (quantity) and monetary unit (price) models are similar when prices relative to relative quantities are equal to 1 (Weisz and Duchin, 2006).

$$\begin{aligned} x_j = i'Z^i + i'Z^m + k_j + l_j + \gamma_j = iZ + v_j \rightarrow x_j\left(\widehat{x_j}\right)^{-1} = i'Z\left(\widehat{x_j}\right)^{-1} + v_j\left(\widehat{x_j}\right)^{-1} = i' \\ = i'A + v_j P \rightarrow i' - i'A = v_j \rightarrow i' = v_j\left(I - A\right)^{-1} \end{aligned} \tag{3}$$

On the sales side, the value of production (x) is measured in the IO table by adding up sales of intermediate inputs domestically $(Z^i i)$ and abroad $(Z^m i)$, plus the final demand components (f), such as consumption (c), investment (r), government expenditure (g) and net exports (o), i.e. exports minus imports of final goods. From this perspective, the quantity model (Miller and Blair, 2009) can be calculated from demand as:

$$x = Z^i i + Z^m i + c + r + g + o = Zi + f \rightarrow \widehat{x_i^{-1}} x_i = \widehat{x_i^{-1}} Z + \widehat{x_i^{-1}} if \rightarrow \; i = Ei + \phi \rightarrow i - Ei = \phi \rightarrow i = \left(I - E\right)^{-1}\left(\phi\right) \quad (4)$$

In this case, both $(I - A)^{-1}$ and $(I - E)^{-1}$ in equations (3) and (4), respectively, are the multiplier matrices. These are useful for studying the economic structure from the IO tables, which set out from the situation of accounting equilibrium.

The model and the IO table refer to the short run (i.e. technology does not change). Empirically, when national and international statistical offices publish new matrices, they always recalculate not only the gross value of production (x, x'), but also the technical and delivery coefficients (A, E). At the same time, it seems that no model has been developed that satisfactorily explains the transition from one year's matrix to the next (Schumann, 1994). Moreover, attempts to construct a dynamic model have not been brought to a satisfactory conclusion (Leontief, 1953 and 1970). Thus, the model has continued to employ comparative statics techniques to analyse the evolution of economies, with emphasis on the differential in the amounts produced by technological change and by final demand (Miller and Blair, 2009).

Setting out from equations (3) and (4), Marquez (2019) studies changes in the inputs and factors used in production by comparing the IO tables for two time periods (0, 1). He uses the Slutsky method to decompose the change in the coefficients contained in the differential $\Delta x = x^1 - x^0$ by two types of effects. The first, the substitution effect, is zero.[1] It refers to the exchange of factor and input coefficients per unit of output. What is involved on the demand side, meanwhile, is the trade-off between the coefficients of intermediate and final demand. The second effect is the price-cost or income-expenditure effect, which suggests a shift in the factors or components driven by the growth rate in the economy. This effect identifies the contributions of the coefficients in the IO table. If the economy today has changed compared to the past, this means that one unit plus the real change is produced. For example, if the economy has grown by 30%, it means that 1.3 units are produced today compared to the past. Assuming that the production functions are subject to constant returns, the 30% change implies a zero increase in the coefficients but a uniform 30% increase in the use of each input (prices are assumed to be invariable), expressed by constant returns $(\Delta x(A^t, v'^t) = x(\Delta A^t, \Delta v'^t))$. Thus, the output increment is equal to $1 + \Delta = x^t(A^t, v'^t) + \Delta(A^t, v'^t) = x^{tt}(A^{tt}, v'^{tt})$. The change, then, can be defined as the difference between the current growth with constant returns and the past ratios, i.e.:

$$\Delta' = \Delta x^{tt}\left(A^{tt}, v'^{tt}\right) - x^{t-1}\left(A^{t-1}, v'^{t-1}\right) = i'\left(\Delta A^{tt} - A^{t-1}\right) + \left(\Delta v'^{tt} - v'^{t-1}\right) \rightarrow \Delta' = i'A^* + v'^* \quad (5)$$

Equation (5) shows the growth path of the economy according to the growth contributions of the factor and input coefficients $(\Delta_j(A^*, v'^*))$. Setting out from this, a simile of the price model is expressed from the Leontief matrix, i.e. the price-cost effect, which, rather than explaining prices by factor coefficients, models growth by factor contributions (see equation (6)):

$$\Delta_j = i'A^* + v_j^* \rightarrow \Delta_j - i'A^* = v_j^* \rightarrow \Delta_j\left(I - \widehat{\Delta_j^{-1}} A^*\right) = v_j^* \rightarrow \Delta_j = v_j^*\left(I - A^{\Delta}\right)^{-1} \quad (6)$$

[1] As demonstrated in the work of Jorgenson and Griliches (1967) and revisited in the subject of productivity from the perspective of the IO model (see Miller and Blair, 2009).

The result of (6) establishes the growth rate of the sector as the product of factor inputs (v'^{*}) and a matrix of multipliers $\left((I-A^{\Delta})^{-1}\right)$ containing the matrix of technical input coefficients $\left(A^{\Delta}=\widehat{\Delta^{-1}}A^{*}\right)$. The value of (6) is not the unit row vector as in the case of (3), but the row vector of growth in the branches.

We can develop equations (5) and (6) in a way that parallels equation (4) and obtain the contributions to growth of the intermediate and final demand coefficients $\left(\Delta\left(E^{*},\varphi^{*}\right)\right)$. Equation (7) establishes the income-expenditure effect with a structure similar to that of Ghosh's (1958) model:

$$\Delta=\left(I-E^{\Delta}\right)^{-1}\varphi^{*} \tag{7}$$

Both the Leontief and Ghosh models are equilibrium models that are deduced from the table, so they combine elements of demand-induced supply or components of supply-induced demand. This decomposition does not do the same because it decomposes the growth rate separately between supply and demand. However, it does enable us to analyse the balance of the contributions of the purchase or sale coefficients. Then, according to equation (5) and its extension for demand, equilibrium implies that the balance is zero. However, as the level of disaggregation of the accounts increases, the balances evince an inverse relationship, as shown in equation (8):

$$\Delta'=\Delta\rightarrow\Delta'-\Delta'=\left(i'A^{*}-\left(E^{*}i\right)'\right)+\left(v^{*\prime}-\varphi^{*\prime}\right)=\rho \tag{8}$$

In equation (8), ρ is a row vector that measures the sum of the differences between the contribution coefficients of intermediate purchases and sales $((i'A^{*}-(E^{*}i)'))$ and of the balance of the contributions of value added with final demand $((v^{*\prime}-\varphi^{*\prime}))$. The result is a null row vector.

The IO table disaggregates the input coefficients into domestic (A_i) and foreign (A_m), and the value added coefficients into employment compensation (w), operating surpluses (k) and production taxes net of subsidies $(tr-\zeta)$. On the demand side, it disaggregates the intermediate demand coefficients into their domestic (E_i) and foreign (E_x) components and the final demand coefficients into private consumption (ϱ), government consumption (γ) and net exports (χ), i.e. exports minus imports. The coefficients of inventory changes and gross fixed capital formation are also disaggregated. However, these items are company expenditures that can be aggregated into one account labelled for the time being as investment (π).

In an equilibrium condition, the changes in supply and demand are the same, so that $\Delta'=\Delta$ is satisfied and thus companies' income is assumed to go to saving and their expenditure to investment. Then, by disaggregating the contributions of the coefficients, we rewrite (8) as (9) in terms of the contribution to growth of the disaggregated coefficients and conclude that the balance of $-\left(k_j^{\Delta}-\pi_i^{\Delta'}\right)$ is equal to the sum of the remainder of the differences in the supply and demand coefficients:

$$\begin{gathered}i'A_i^{\Delta}+i'A_m^{\Delta}+w^{\Delta'}+k^{\Delta'}+\left(tr-\zeta\right)^{\Delta'}=E_i^{\Delta}i+E_x^{\Delta}i+\varrho^{\Delta}+\pi^{\Delta}+\gamma^{\Delta}+\chi^{\Delta}\rightarrow\\-\left(k^{\Delta'}-\pi^{\Delta'}\right)=\left(i'A_i^{\Delta}-\left(E_i^{\Delta}i\right)'\right)+\left(i'A_m^{\Delta}-\left(E_x^{\Delta}i\right)'\right)+\left(w^{\Delta'}-\varrho^{\Delta'}\right)+\left(\left(tr-\zeta\right)^{\Delta'}-\gamma^{\Delta'}\right)-\chi^{\Delta'}\\-Fn^{\Delta}=\left(Pr_i^{\Delta}\right)+\left(Pr_{xm}^{\Delta}\right)+\left(Pv^{\Delta}\right)+\left(Pb^{\Delta}\right)-\chi_i^{\Delta'}\end{gathered} \tag{9}$$

Equation (9) shows that the discrepancies between the growth contributions of $k^{\Delta\prime}$ and π^{Δ} are equal to the sum of the domestic $\left(Pr_i^{\Delta}\right)$ and external $\left(Pr_{xm}^{\Delta}\right)$ production, private (Pv^{Δ}), public (Pb^{Δ}) and trade (χ^{Δ}) balances measured by the equality of supply and demand growth when output changes and expressed by the balance of the contributions of the supply factors and the demand components.

Just as income and production are the same in the short run in national accounting, here we assume that growth is the same across these variables. This identity allows us to formulate equation (9).[2]

It has been shown from demand models (Harrod, 1939) that in the dynamic equilibrium between supply and demand, when the economy grows, the growth condition is that the natural rate and the warranted rate be the same between saving and investment. In the case of equation (9), if the financial balance $\left(-Fn^{\Delta}=-\left(k_j^{\Delta}-\pi_i^{\Delta'}\right)=0\right)$ and all other differences are also zero, change allows aggregate output to grow with price stability.

If the growth path is intensive, i.e. growth is mainly explained by some supply or demand component but satisfies the condition $k^{\Delta}=\pi^{\Delta} \therefore Fn^{\Delta}=0$, then the intensity of that factor causes a deficit or surplus in its balance and its opposite in the other differences in equation (9). However, the paths along which the system operates are different and can even be combined.

At the level of aggregate supply and demand, if $Fn^{\Delta}=0$ but there is a growth path with an intensive factor, supply and demand shifts are prone to imbalances between k^{Δ} and π^{Δ}, and the economy may exhibit price-distorting growth. When $Fn^{\Delta}>0$, the increase in demand is greater than the increase in supply, and investment contributes more than saving. There are consequently surpluses in the other items in equation (9), and the system tends to have higher price increases because of the supply effect than because of the demand effect. In the case of $Fn^{\Delta}<0$, i.e. when saving contributes more than investment, the impact on the aggregate equilibrium point of the market is a decrease in prices with an increase in quantities. This is because demand increases by less than supply. Falling prices imply a devaluation of the economic system and suggest that the economy is running deficits in other balances. According to this circularity reasoning, the only way to guarantee growth without higher prices is for the proportions of supply- and demand-driven growth to be the same, since an increase in one factor entails an increase in one component.

III. The Mexican economy

After the 1980 crisis, the Mexican economy transformed its economic structure and brought in a development strategy based on trade liberalization and market deregulation, among other measures (De Souza and Gómez, 2018; Guillén, 2010; Ruiz-Nápoles, 2004). Monetary policy until 1994 focused on discussion of how to increase investment incentives. Thereafter, monetary policy focused on the inflation targeting regime (Capraro and Perrotini, 2011).

This process transformed the conditions of the production structure, since opening up the economy had the potential to lead to increased investment. Thus, the signing of the North American Free Trade Agreement (NAFTA) solved the problem of growth by attracting foreign direct investment (FDI) from the United States (Pastor, 2012) and even resulted in more diversified exports. From consisting mainly of oil, they became mainly industrial (Ruiz-Nápoles, 2004), but at the same time interdependent with the United States business cycle (Antón 2011; Aroche and Marquez, 2016).

However, Mexico's low rates of economic growth have been explained by the influence of the exchange rate as an investment determinant (Moreno-Brid, 1998; Puyana and Romero, 2010; Blecker, 2009; Ibarra, 2008). These low rates have also been explained by imbalances between the natural and warranted rate in Harrod's (1939) model, resulting from a low level of productivity relative to the investment coefficient. This implies capital accumulation and lower employment (Avendaño and Perrotini, 2015; Ros, 2008).

[2] From the aggregate point of view, in an economy with a State and an external sector, the income and output identity dictates that the difference between private sector saving and investment is equal to the public deficit plus the trade surplus (Dornbusch, Fischer and Startz, 2004).

The Mexican economy has moved from internal to external industrialization, which is more vulnerable to shocks from the international economy. Studies on the economic structure have confirmed that the low level of growth and employment is due to the weakness of the internal linkages underpinning the economic structure (Aroche, 2006; Ruiz-Nápoles, 2007; Marquez, 2018). Zárate and Molina (2017) argue that the integration of this structure into global processes is reflected in the substitution of domestic inputs by imported inputs and that the domestic structure does not have the capacity to benefit from international trade. Other types of studies have pointed out that the low level of growth is due to a lack of dynamism in the industrial sector, low productivity and balance-of-payments constraints (Avendaño and Perrotini, 2015; Calderón and Sánchez, 2012; Moreno-Brid, 1998; Morones, 2016; Ros, 2013; Sánchez and Moreno-Brid, 2016).

Owing to the change in the disaggregation criteria of INEGI, it is impossible to analyse economic activity in conjunction with structural change in Mexico, which would come out in the methodology for measuring output, since from a statistical point of view a change in the way economic activity is disaggregated signals a change in structure (Aroche, 2006). The analysis of the period 1980–2013 has been carried out using the databases prepared in accordance with the two methodologies described, one for the period 1980–1993 and the other for the period 1993–2016, and published by INEGI. However, these two periods represent two distinct major stages in the transition of the economic model and structural change in the Mexican economy.

The first database, covering the period 1980–1993, covers the process of economic policy transformation. A number of events altered the course of the economy. The change in the export model during this period involved the start and continuing pursuit of market deregulation and disengagement from economic activities previously considered strategic, as well as export-led growth.

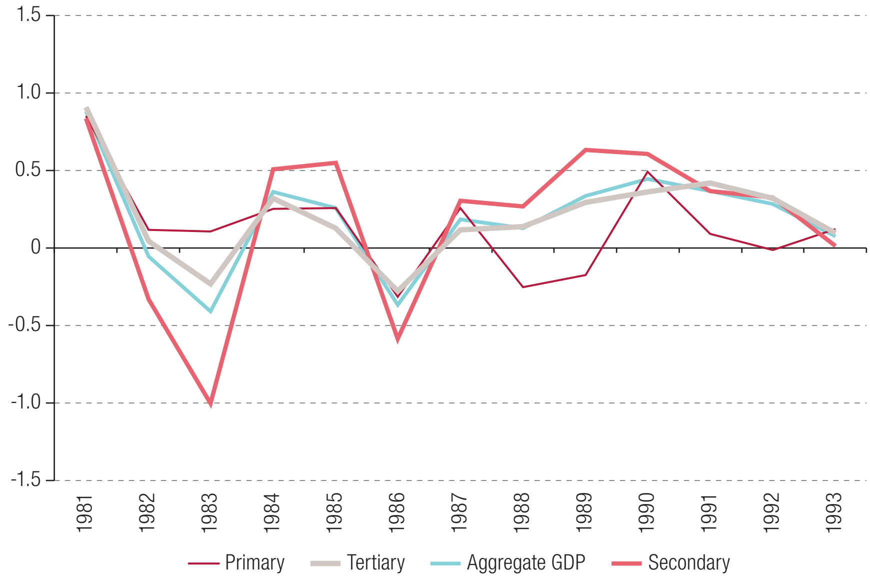
Figure 1 shows the growth rates of gross domestic product (GDP) in the whole economy and in the primary, secondary and tertiary sectors for the period 1980–1993 at 1993 prices, according to INEGI data. It shows the drop in 1983 due to the debt crisis a year earlier, and that of 1986 due to the fall in oil prices in 1985, which combined with inflation and devaluation of the currency against the dollar. Average growth during the period was 0.19%.[3] Correlation was higher, slightly more so in the service sector than in the industrial sector.

In 1994, the process of adopting the new growth model ended and a period characterized by a policy of preferential export promotion (essentially with the United States) began, continuing to the present day (Ruiz-Nápoles, 2007). The political cycle began to become desynchronized from the economic cycle: as the data reveal, the Fox, Calderón and Peña administrations did not experience crises in their election years, as was previously the case (Guillén, 2010). Figure 2 shows the GDP performance of the economy and the different sectors at 1993 prices during the period 1994–2016, when the average growth rate of 2.5% had a 98% correlation with industrial growth and 96% with that of services. This period of preferential export promotion policy can be divided into two subperiods, the first from 1994 to 2001 and the second from 2002 to 2016. The 1994–2001 subperiod was characterized by average growth of 3%. The signing of NAFTA allowed FDI to increase and act as a lever of growth (Ros, 2004). In addition, this period was characterized by diplomatic ties that fostered integration with the United States (Pastor, 2012).

The economy managed an export boom during this period, as it shifted from a primary economy to one diversified into labour-intensive medium-technology manufacturing (Ros, 2004). The Mexican economy had to cope with external factors that caused a change in the dynamism of trade and output at that time. Externally, the pace of trade slowed owing to non-tariff barriers after the attacks on the United States in 2001 (Pastor, 2012). Domestically, trade was changed as a result of reforms to free zones by the 2002 border area and border strip regime in Mexico.

[3] This growth rate is close to the 0.16% calculated by Márquez (2010) for the period 1981–1988, when he analysed structural change from the perspective of the behaviour and composition of output from 1921 to 2007.

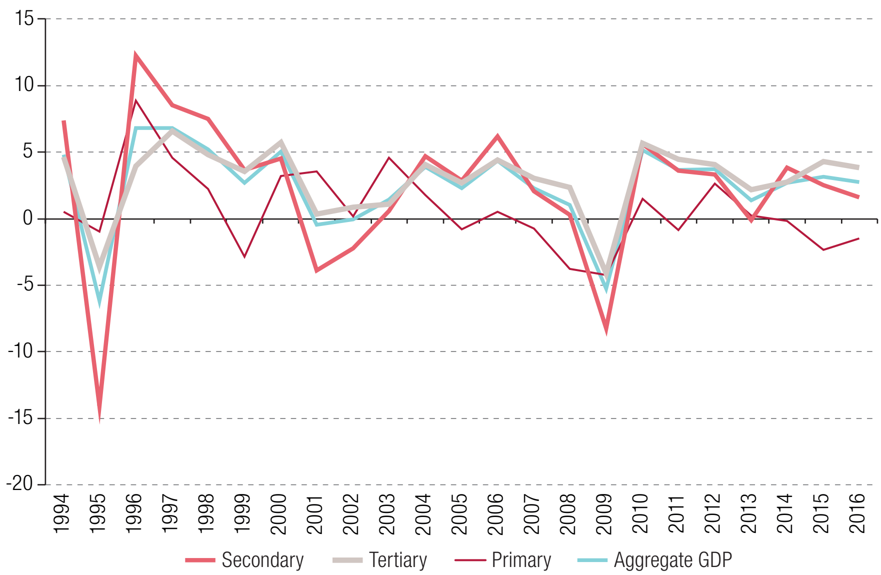
Figure 1
GDP growth in the aggregate and by sector, at 1993 prices, 1981–1993
(Percentages)



Source: Prepared by the author, on the basis of data from the National Institute of Statistics and Geography (INEGI).

The subperiod 2002–2016 was characterized by the dominance of preferential manufacturing export trade to the United States market and a diversified import trade. This increase in imports from other countries, such as China, created a trade deficit in the auto parts market (Álvarez and Cuadros, 2012). As figure 2 shows, the average growth rate was 2.3% during the period 2002–2016. The data show that the decline in 2009 was made up for by growth in 2010. This subinterval was characterized by macroeconomic stability and strategic reforms, such as the 2013 energy and education reform and the 2014 financial reform.

Figure 2
GDP growth in the aggregate and by sector, at 1993 prices, 1994–2016
(Percentages)



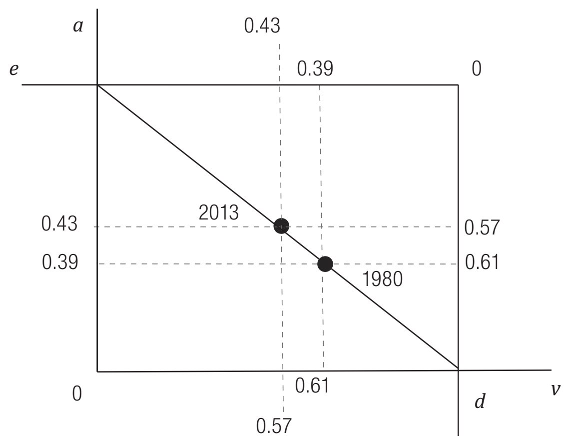
Source: Prepared by the author, on the basis of data from the National Institute of Statistics and Geography (INEGI).

The export-led economic growth model resulted in both FDI and manufacturing exports increasing (Ros, 2008). However, not only was growth low, but so was per capita income, and this went together with income concentration problems and low rates of expansion of formal employment, owing to a rise in informal employment (Fujii, 2003; Cruz, 2013; Ros, 2004). It seems that trade and investment effects have not acted as growth determinants. This context suggests a hypothesis: that the increase in investment in the economy is not correlated with savings, since export growth has produced a surplus and imported intermediate inputs have grown by more than domestically produced ones. Therefore, the financial surplus is composed of an external production surplus and net exports, with a domestic production deficit, private and public, resulting from the disruption of the industrial system and the profile of the economic growth model.

IV. Results

Figure 3 shows the general equilibrium of the economy, i.e. the aggregate output of its branches in the 1980 and 2013 IO tables, expressed by the input *(a)* and value added *(v)* coefficients for supply and by the delivery *(e)* and final demand *(d)* coefficients for demand. These coefficients express proportions per unit of output; for example, one unit of output explained by supply is composed at the 1980 point by 0.61 of the *v* coefficient and 0.39 of the *a* coefficient, and by the same proportions for the *e* and *d* coefficients, respectively. The isoquant of supply and demand is one of equilibrium with a vector of unit prices, as shown by the diagonal of the box in figure 3.

Figure 3
Mexico: general equilibrium, 1980 and 2013
(Coefficients per unit of output)



Source: Prepared by the author, on the basis of data from the National Institute of Statistics and Geography (INEGI), input-output tables.

The chart shows that between 1980 and 2013 the economy's *v* coefficient decreased and *a* increased (from 0.39 to 0.43 per unit of output). Internally in *a*, the imported input coefficient increased from 0.04 to 0.14. At the same time, the composition of the *v* coefficient underwent a decline (from 0.61 to 0.57), composed of an increase in the gross operating surplus (from 0.37 to 0.40) and a fall in the employee compensation coefficient (from 0.17 to 0.16) and in indirect taxes net of subsidies (from 0.06 to 0.003). These results can be explained by low labour productivity and the low rate of accumulation (Avendaño and Perrotini, 2015; Ros, 2008).

On the demand side, figure 3 shows an increase in the coefficient of intermediate demand (e) as a counterpart to the increase in the aggregate coefficient of intermediate consumption. Analysis of the composition of the d coefficient shows that the total coefficient of private consumption decreased (from 0.42 to 0.37); that of government expenditure increased (from 0.03 to 0.07); that of investment (i.e. gross capital formation together with the change in inventories) held steady at 0.13%; and, lastly, that of net exports fell (from 0.02 to -0.01).

Table 1 shows the composition of output by sector of the economy (x') over the total for the economy (X), i.e. $\frac{x'}{X}$ and the supply and demand coefficients for each of them, calculated on the basis of the IO tables. It can be seen that the share of output increased in the service sector, to the detriment of the primary and secondary sectors. On the supply side, the use of domestic intermediate input coefficients $(i'A^i)$ decreased between 1980 and 2013, while that of imported ones $(i'A^m)$ increased. The operating surplus (k) coefficients of the primary and service sectors increased, while in industry they remained almost the same as in 1980. Wage (w) coefficients decreased in all sectors. Broadly speaking, intermediate input coefficients increased and value added coefficients decreased.

On the demand side, table 1 shows that the intermediate sales coefficients $((E^i i)')$ decreased. The external sales coefficients $((E^m i)')$ increased in the industrial sector, decreased in the primary sector and remained unchanged in services. Consumption coefficients (ϱ) decreased in all sectors, and government expenditures (γ) increased only in services, decreasing in the primary and secondary sectors. Investment coefficients (π) increased in all sectors except services. Net export coefficients (χ) increased in the primary and industrial sectors, while they declined in the tertiary sector. Overall, intermediate sales increased in the secondary and tertiary sectors, but declined in the primary sector. Final demand was higher in the primary sector than in the industrial and tertiary sectors.

Table 1

Composition of the gross value of production by sector and supply and demand coefficients in the input-output matrices, 1980 and 2013

(Units of output)

Sector	1980											
	$\frac{x'}{X}$ *(percentages)*	$i'A^i$	$i'A^m$	w'	k'	$(tr-\xi)'$	$(E^i i)'$	$(E^m i)'$	ϱ'	γ'	π'	χ'
Primary	12	0.24	0.01	0.18	0.56	0.00	0.60	0.07	0.26	0.00	0.06	0.02
Secondary	46	0.51	0.08	0.15	0.24	0.03	0.36	0.07	0.38	0.01	0.22	-0.03
Tertiary	42	0.20	0.01	0.20	0.47	0.12	0.27	0.01	0.51	0.06	0.07	0.09
Sector	2013											
	$\frac{x'}{X}$	$i'A^i$	$i'A^m$	w'	k'	$(tr-\xi)'$	$(E^i i)'$	$(E^m i)'$	ϱ'	γ'	π'	χ'
Primary	8	0.21	0.07	0.07	0.66	0.00	0.53	0.06	0.07	0.00	0.10	0.24
Secondary	42	0.42	0.26	0.09	0.23	0.00	0.24	0.31	0.29	0.00	0.26	-0.11
Tertiary	49	0.20	0.05	0.24	0.50	0.01	0.30	0.01	0.49	0.14	0.03	0.03

Source: Prepared by the author on the basis of the 1980 matrix (at 2013 prices) and of National Institute of Statistics and Geography (INEGI), 2013 input-output tables.

Note: The expressions denote the following concepts:

$\frac{x'}{X}$: Composition of output.
$i'A^i$: Domestic intermediate inputs coefficients
$i'A^m$: Imported intermediate input coefficients.
w' : Wage coefficients.
k' : Operating surplus coefficients.
$(tr-\xi)'$: Coefficients of taxes net of production subsidies.
$(E^i i)'$: Domestic intermediate demand coefficients.
$(E^m i)'$: Imported intermediate demand coefficients.
ϱ' : Final consumption coefficients.
γ' : Government spending coefficients.
π' : Investment coefficients.
χ' : Net export coefficients.

At the sector level, the economic data show that intermediate consumption and final demand decreased in the primary sector, which means that value added and intermediate demand increased. In the case of industry and services, intermediate consumption and intermediate demand increased and value added and final demand decreased.

In order to decompose the changes in output in the economy during the period 1980–2016, we used the average growth rates for output, the sectors and the branches with the two INEGI databases available, which were used to analyse the behaviour of GDP in the previous section. Table 2 shows the composition of the growth path according to the average change in output (Δ) in the two databases. The growth path followed by the economy resulted in an expansion of 1.34%, and from a supply side perspective was intensive in intermediate input coefficients and operating surpluses. On the demand side, the path was biased towards intermediate demand coefficients. In private consumption, the growth path of the economy moved from one Cartesian coordinate of inputs and factors (0.4337 and 0.5663) to another (0.4396 and 0.5738) whose combination produces 1.0134 units, i.e. a change of 1.34%.

Table 2

Growth contributions by supply factor and demand component, 1980–2016

(Percentages)

Sector	Supply						Demand					
	Δ	$iA_i^{\Delta'}$	$iA_m^{\Delta'}$	w'^{Δ}	k'^{Δ}	$(tr-\zeta)'^{\Delta}$	$E_i^{\Delta}i'$	$E_m^{\Delta}i'$	ϱ'^{Δ}	γ'^{Δ}	π'^{Δ}	χ'^{Δ}
Total	1.34	-5.11	10.07	-0.84	3.16	-5.94	0.39	0.19	0.50	0.10	0.18	-0.01
Primary	0.43	-3.34	5.78	-11.41	9.47	-0.08	0.23	0.02	0.03	0.00	0.04	0.10
Secondary	1.18	-8.12	18.34	-5.55	-0.79	-2.71	0.29	0.37	0.35	0.00	0.31	-0.13
Tertiary	1.59	-0.32	4.20	4.42	4.45	-11.15	0.47	0.01	0.78	0.23	0.04	0.06
Branch	Δ_i	$iA_i^{\Delta'}$	$iA_m^{\Delta'}$	$w_j^{\Delta'}$	$k_j^{\Delta'}$	$(tr-\zeta)_j^{\Delta'}$	$E_i^{\Delta}i'$	$E_m^{\Delta}i'$	ϱ_i^{Δ}	π_i^{Δ}	γ_i^{Δ}	χ_i^{Δ}
Agriculture, animal husbandry, forestry, fisheries and hunting	0.98	5.89	7.76	-8.41	-4.86	0.60	0.62	0.12	0.21	0.00	0.06	-0.03
Mining	0.23	-5.90	3.29	-10.98	16.00	-2.17	0.11	0.00	0.00	0.00	0.03	0.09
Electricity generation, transmission and distribution, supply of piped water and gas to final consumers	2.54	-12.93	13.22	-13.46	16.63	-0.91	1.88	0.01	0.64	0.00	0.00	0.02
Construction	1.08	-35.93	4.74	1.71	30.49	0.07	0.10	0.00	0.00	0.00	0.98	0.00
Food industry	1.24	-17.76	0.91	-0.18	16.44	1.83	0.22	0.06	1.03	0.00	0.01	-0.08
Drinks and tobacco industry	1.61	4.80	9.26	-8.76	15.81	-19.51	0.08	0.01	1.35	0.00	0.02	0.13
Manufacture of textile inputs and textile finishing	-0.45	11.42	19.88	-6.69	-21.68	-3.38	-0.29	-0.38	-0.08	0.00	0.00	0.30
Manufacture of textile products other than apparel	-0.72	8.73	27.64	1.58	-41.50	2.83	-0.17	-0.19	-0.36	0.00	-0.03	0.03
Manufacture of apparel	0.02	-11.44	22.01	4.10	-8.92	-5.73	0.00	0.00	0.01	0.00	0.00	0.00
Tanning and finishing of hides and leather and manufacture of products of hide and leather and substitutes thereof	-0.73	-4.21	16.75	-8.11	-4.43	-0.74	-0.12	-0.17	-0.63	0.00	-0.02	0.21
Wood industry	-0.01	6.68	10.56	-1.37	-13.57	-2.31	-0.01	0.00	-0.01	0.00	0.00	0.00
Paper industry	1.71	9.90	17.20	-7.94	-13.82	-3.64	1.02	0.84	0.53	0.00	0.05	-0.73
Printing and allied industries	0.54	6.72	5.48	-3.57	-4.31	-3.79	0.35	0.11	0.15	0.02	0.00	-0.10
Manufacture of oil and coal derivatives	0.19	-58.52	9.41	21.24	21.37	6.70	0.12	0.07	0.06	0.00	0.00	-0.06
Chemical industry	0.66	-0.91	11.66	-7.99	-1.03	-1.06	0.32	0.38	0.27	0.00	0.02	-0.33
Plastic and rubber industry	1.14	6.13	21.44	-8.23	-12.34	-5.85	0.56	0.74	0.34	0.00	0.03	-0.53
Manufacture of products from non-metallic minerals	0.81	28.03	9.21	-9.54	-24.01	-2.88	0.62	0.12	0.06	0.00	0.00	0.00
Basic metal industries	1.00	-6.03	5.04	-6.86	9.62	-0.75	0.57	0.39	0.00	0.00	0.10	-0.05
Metal products manufacturing	1.17	12.33	11.28	-9.56	-4.99	-7.89	0.54	0.82	0.19	0.00	0.11	-0.48
Machinery and equipment manufacturing	1.89	-3.09	29.35	-9.02	-11.83	-3.52	0.09	1.57	0.04	0.00	1.74	-1.55
Manufacture of computer, communication, measuring and other equipment and electronic components and accessories	1.93	-14.27	64.46	-17.14	-27.00	-4.12	0.02	1.54	0.25	0.00	0.37	-0.25

Table 2 (concluded)

Branch	Supply						Demand					
	Δ_i	$iA_i^{\Delta'}$	$iA_m^{\Delta'}$	$w_j^{\Delta'}$	$k_j^{\Delta'}$	$(tr-\zeta)_j^{\Delta'}$	$E_i^{\Delta}i'$	$E_m^{\Delta}i'$	ϱ_i^{Δ}	π_i^{Δ}	γ_i^{Δ}	χ_i^{Δ}
Manufacture of electricity generation accessories, electrical appliances and equipment	1.31	-0.83	42.42	-14.19	-22.35	-3.74	0.11	0.89	0.23	0.00	0.20	-0.13
Manufacture of transport equipment	3.50	-2.93	24.74	-12.38	-2.02	-3.91	0.39	0.81	0.81	0.00	0.62	0.86
Other manufacturing industries	1.58	3.74	36.99	0.00	-34.96	-4.18	0.26	0.82	0.62	0.00	0.14	-0.26
Commerce	1.88	6.07	2.57	-3.89	17.60	-20.46	0.63	0.00	0.85	0.00	0.14	0.26
Transport, post and storage	1.59	-7.00	5.25	-1.07	2.44	1.97	0.36	0.00	1.04	0.00	0.10	0.08
Information in mass media	4.66	18.75	7.60	-23.12	17.06	-15.64	1.98	0.02	2.61	0.01	0.06	-0.02
Financial and insurance services	4.81	19.90	3.65	-39.49	12.64	8.11	1.22	0.41	3.37	0.02	0.00	-0.21
Real estate and movable and intangible goods leasing services	1.66	1.18	1.29	-0.65	4.89	-5.05	0.30	0.00	1.35	0.00	0.01	0.00
Professional, scientific and technical services	1.33	-17.99	3.60	24.46	-7.29	-1.45	1.21	0.04	0.09	0.02	0.00	-0.04
Education services	0.86	-15.35	1.81	6.57	7.17	0.67	0.01	0.00	0.19	0.67	0.00	0.00
Health and social assistance services	1.12	-20.18	3.72	21.47	-5.95	2.06	0.01	0.00	0.31	0.80	0.00	0.00
Cultural and sporting leisure services and other recreational services	0.38	-15.20	3.19	2.32	8.70	1.36	0.02	0.00	0.32	0.03	0.00	0.00
Temporary accommodation and food and drink preparation services	0.58	-7.02	5.22	1.24	3.82	-2.68	0.09	0.00	0.49	0.00	0.00	0.00
Other services except government activities	66.50	-60.79	3.25	43.76	11.76	2.69	0.06	0.00	0.17	0.44	0.00	0.00

Source: Prepared by the author, on the basis of data from the National Institute of Statistics and Geography (INEGI), input-output tables of 1980 and 2013.

Note: The expressions denote the following:

Δ : Growth rate.
$iA_i^{\Delta'}$: Growth contribution of domestic input coefficients.
$iA_m^{\Delta'}$: Growth contribution of imported input coefficients.
w'^{Δ} : Growth contribution of wage coefficients.
k'^{Δ} : Growth contribution of operating surplus coefficients.
$(tr-\zeta)_j^{\Delta'}$: Growth contribution of coefficients of production taxes net of subsidies.
$E_i^{\Delta}i'$: Growth contribution of domestic intermediate demand coefficients.
$E_m^{\Delta}i'$: Growth contribution of imported intermediate demand coefficients.
ϱ'^{Δ} : Growth contribution of final consumption coefficients.
γ'^{Δ} : Growth contribution of government expenditure coefficients.
π'^{Δ} : Growth contribution of investment coefficients.
χ'^{Δ} : Growth contribution of net export coefficients.

At the sectoral level, services grew most. Structural change was driven by changes in the composition and growth of output (Márquez, 2010); data from the 1980 and 2013 IO tables confirm this. The contributions of the service factors were driven by the coefficients of imported inputs, wages and capital payments. In the secondary sector, their growth was due to imported intermediate inputs, while in the primary sector it was due to capital payments along with inputs. Thus, on the supply side, imported intermediate inputs contributed most to the growth of the sectors and the economy.

On the demand side, growth in the primary sector was driven by domestic intermediate sales and net exports. In the secondary sector, it was explained by external intermediate demand, consumption and government spending. In the tertiary sector, the external intermediate sales, consumption and investment components contributed most to the sector's growth.

At the branch level, the results can be aggregated into five groups: (i) the group of branches that grew the most, falling within a range of $\Delta > 2\%$ (5 branches); (ii) the second set, of activities growing in the range $1.5\% < \Delta_i < 2\%$ (8 branches); (iii) the third, in the range of $1\% < \Delta < 1.5\%$ (8 branches); (iv) the fourth, in the range of $0\% < \Delta < 1\%$ (10 branches); and (v) the group in which the branches presented declines, i.e. $\Delta < 0\%$ (4 branches). Thus, considering the dynamism displayed in each group, the service sector proves to be the most dynamic in the first. This sector contains the two most dynamic branches in the production structure, financial services and media information services, which are intensive in the domestic input and operating surplus coefficients.

In each of the groups, the best-performing branches were intensive in imported intermediate inputs. In particular, "other services except government activities" performed best in the first group, "manufacture of computer, communication, measuring and other equipment and electronic components and accessories" in the second, "professional, scientific and technical services" in the third, "agriculture, animal husbandry, forestry, fisheries and hunting" in the fourth and "tanning and finishing of hides and leather and manufacture of products of hide and leather and substitutes thereof" in the fifth, with growth that was intensive in imported intermediate inputs.

On the final demand side, the leading branches in the first, third and fourth groups are financial services, professional services and agriculture, which are intensive in domestic intermediate sales and in consumption. In the second group, the electronics branch is intensive in external intermediate sales and government spending. Lastly, in the fifth group, the tanning industry is intensive in net exports. This last intensity feature is maintained in those branches that are neither the most dynamic nor the most sophisticated in terms of production. In most branches of the production structure, however, net exports do not contribute to growth.

Table 3 shows the balances of factor contributions and supply and demand components, respectively. As discussed in the first section, the table has been constructed on the assumption that saving is carried out by businesses through the gross operating surplus account. Therefore, from the demand point of view, the flow of such income is earmarked for investment. However, even if equation (8) is satisfied, table 3 is read as branch revenue minus branch expenditure.

Table 3

Balances of the growth contributions of factors and components

(Percentages)

Sector	Balance					
	Fn^{Δ}	Pr_i^{Δ}	Pr_x^{Δ}	Pv^{Δ}	Pb^{Δ}	χ^{Δ}
Total	3.1	-5.5	9.9	-1.3	-6.1	0.012
Primary	9.3	-3.6	5.8	-11.4	-0.1	0.100
Secondary	-0.5	-8.4	18.0	-5.9	-3.0	-0.130
Tertiary	4.1	-0.8	4.2	3.6	-11.2	0.060
Branch	Fn^{Δ}	Pr_i^{Δ}	Pr_x^{Δ}	Pv^{Δ}	Pb^{Δ}	χ^{Δ}
Agriculture, animal husbandry, forestry, fisheries and hunting	-5	5.3	7.6	-8.6	0.5	0.030
Mining	16	-6.0	3.3	-11.0	-2.2	0.089
Electricity generation, transmission and distribution, supply of piped water and gas to final consumers	17	-14.8	13.2	-14.1	-0.9	0.020
Construction	30	-36.0	4.7	1.7	-0.9	0.000
Food industry	16	-18.0	0.8	-1.2	1.8	-0.078
Drinks and tobacco industry	16	4.7	9.2	-10.1	-19.5	0.135
Manufacture of textile inputs and textile finishing	-22	11.7	20.3	-6.6	-3.4	0.304
Manufacture of textile products other than apparel	-41	8.9	27.8	1.9	2.9	0.026
Manufacture of apparel	-9	-11.4	22.0	4.1	-5.7	0.001
Tanning and finishing of hides and leather and manufacture of products of hide and leather and substitutes thereof	-4	-4.1	16.9	-7.5	-0.7	0.208
Wood industry	-14	6.7	10.6	-1.4	-2.3	0.001
Paper industry	-14	8.9	16.4	-8.5	-3.7	-0.727
Printing and allied industries	-4	6.4	5.4	-3.7	-3.8	-0.098
Manufacture of oil and coal derivatives	21	-58.6	9.3	21.2	6.7	-0.057
Chemical industry	-1	-1.2	11.3	-8.3	-1.1	-0.334
Plastic and rubber industry	-12	5.6	20.7	-8.6	-5.9	-0.534
Manufacture of products from non-metallic minerals	-24	27.4	9.1	-9.6	-2.9	0.005

Table 3 (concluded)

Branch	Balance					
	Fn^{Δ}	Pr_i^{Δ}	Pr_x^{Δ}	Pv^{Δ}	Pb^{Δ}	χ^{Δ}
Basic metal industries	10	-6.6	4.6	-6.9	-0.9	-0.054
Metal products manufacturing	-5	11.8	10.5	-9.7	-8.0	-0.484
Machinery and equipment manufacturing	-14	-3.2	27.8	-9.1	-5.3	-1.547
Manufacture of computer, communication, measuring and other equipment and electronic components and accessories	-27	-14.3	62.9	-17.4	-4.5	-0.246
Manufacture of electricity generation accessories, electrical appliances and equipment	-23	-0.9	41.5	-14.4	-3.9	-0.127
Manufacture of transport equipment	-3	-3.3	23.9	-13.2	-4.5	0.862
Other manufacturing industries	-35	3.5	36.2	-0.6	-4.3	-0.261
Commerce	17	5.4	2.6	-4.7	-20.6	0.260
Transport, post and storage	2	-7.4	5.2	-2.1	1.9	0.083
Information in mass media	17	16.8	7.6	-25.7	-15.7	-0.021
Financial and insurance services	13	18.7	3.2	-42.9	8.1	-0.213
Real estate and movable and intangible goods leasing services	5	0.9	1.3	-2.0	-5.1	-0.004
Professional, scientific and technical services	-7	-19.2	3.6	24.4	-1.5	-0.038
Education services	7	-15.4	1.8	6.4	0.7	0.000
Health and social assistance services	-6	-20.2	3.7	21.2	2.1	0.000
Cultural and sporting leisure services and other recreational services	9	-15.2	3.2	2.0	1.4	0.000
Temporary accommodation and food and drink preparation services	4	-7.1	5.2	0.8	-2.7	0.000
Other services except government activities	12	-60.8	3.2	43.6	2.7	-0.001

Source: Prepared by the author, on the basis of data from the National Institute of Statistics and Geography (INEGI), input-output tables.

Note: The expressions denote the following:
Fn^{Δ} : Financial balance.
Pr_i^{Δ} : Domestic production balance.
Pr_x^{Δ} : External production balance.
Pv^{Δ} : Private sector balance.
Pb^{Δ} : Public sector balance.
χ^{Δ} : Contribution of net exports.

The table 3 results suggest that in the Mexican economy the financial balance, i.e. the difference between the contributions of savings and investment (Fn^{Δ}), is in surplus and is underpinned by the domestic (Pr_i^{Δ}), private (Pv^{Δ}) and public (Pb^{Δ}) production deficits. The external production $\left(Pr_x^{\Delta}\right)$ and trade (χ^{Δ}) surpluses reflect the logic that revenues are greater than expenditures, suggesting that they do not contribute to the (Fn^{Δ}) surplus, but rather diminish it.

At the aggregate level, the Mexican economy does not meet the zero balances condition, which means that its growth path is not the most favourable. At the sector level, both the primary and tertiary sectors maintain the characteristics of the Fn^{Δ} surplus and their respective deficits. The industrial sector presents a Fn^{Δ} deficit which is underpinned by the external production surplus Pr_x^{Δ}.

According to Marquez (2019), economies are unlikely to experience zero financial balances at the aggregate level. As more branches approach this balance from the left or right, the economy can be said to be developed. Using the author's criterion for a set of developed economies, i.e. a range between a Fn^{Δ} surplus of 0.1% and a deficit of -0.1%, no branch in the Mexican economy is found to approach these levels. The branch closest to this range is chemicals, with a deficit of -1%, which is sustained by the Pr_x^{Δ} surplus. At the other extreme, the branch that is furthest from $Fn^{\Delta} = 0$ is the "manufacture of textile products other than apparel" branch, with a balance of -41%, owing to surpluses in the remaining balances.

The results in table 3 show that the financial surplus of the primary sector is due to the surplus of the mining industry. In the service sector, meanwhile, it is the commerce and information in mass media branches that account for the surpluses, with the latter being one of the most dynamic.

If the criterion of grouping branches by the growth rate in each sector is maintained (see tables 2 and 3), it can be seen that the branches that are most prominent in the first and third groups show opposite situations in their main balances. While the Fn^{Δ} of the "other services" branch is in surplus, that of the "professional services" branch is in deficit. What contributes to these results is Pr_x^{Δ}, which is in deficit in one case and in surplus in the other. In the second and fifth groups, the branches with the highest growth according to their range have Fn^{Δ} deficits and rely on the Pr_x^{Δ} surpluses. In the case of the fourth group, agriculture has a Fn^{Δ} deficit to which all balances except that of Pr_x^{Δ}, which is in deficit, contribute. If FDI has grown in the economy, the positive balances seem to suggest that earnings have been greater, and these are due to the Pr_i^{Δ}, Pv^{Δ} and Pb^{Δ} deficits.

V. Conclusions

As discussed earlier, the hypothesis regarding the development of an economy is based on productive integration: the more sophisticated this is, the more development there will be. It also seems to be true that the greater the number of branches meeting the condition of zero financial balances for factor and component contributions, the more developed the economy will be.

Structural change depends not only on the productive sector, developing in the interrelationships between purchases and sales of intermediate inputs, but also on the agents that make up the system. Accordingly, the balances of contributions to production, i.e. the branches' purchases and sales of intermediate inputs and agents' income or expenditure, measured via the components of value added and final demand, show how the change is constituted.

This paper has not followed the traditional approach to using the IO model to study the economic system (i.e. focusing on the analysis of intersectoral relations). However, it opens the way to a new aspect of the model in its dynamic character that makes it possible to analyse changes in intersectoral relations, as this perspective is supported by the components of the IO table and their translation into economic theory.

From this analysis, the results for the Mexican economy show that it has been intensive in intermediate inputs from abroad. They also indicate that this path, together with the trade balance of growth contributions, has been the basis for the financial surplus, which is constituted by a domestic production deficit in both the private and public sectors. The positive net export balance of the economy is explained by the basic branches of industry and the primary sector, since in most of industry these balances are negative.

Thus, in addition to using industrial policy to help create a coherent domestic industrial structure, there is a need to transfer part of the public deficit to the private sector. Even if this does not put the economy on an optimal development path, it will provide a basis for better development of the population.

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