Economic growth and productivity in French Polynesia: a long-term analysis

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Abstract – After a very rapid economic boom in the sixties, due to the installation of the Pacific Testing Centre and the construction of airports in Tahiti and its islands, French Polynesia experienced an almost continuous decline in its growth during the next four decades, before plunging into an economic depression since 2009. This research analyses the factors of growth (labour, capital intensity, human capital, total factor productivity) in French Polynesia over the period 1960-2006, after reconstituting long and consistent series of the variables studied and compares them with metropolitan France (including overseas Departments). Total factor productivity has been a negative contributor to growth over 1988-1996 and since 2001. These long episodes of low total factor productivity could be indicative of the existence of significant structural barriers to growth, such as high costs typical of small island economies, as well as misallocation of resources due to a lack of entrepreneurial dynamism and an excess of protectionism.

JEL Classification : O47, O56
Keywords: GDP, growth, productivity, French Polynesia

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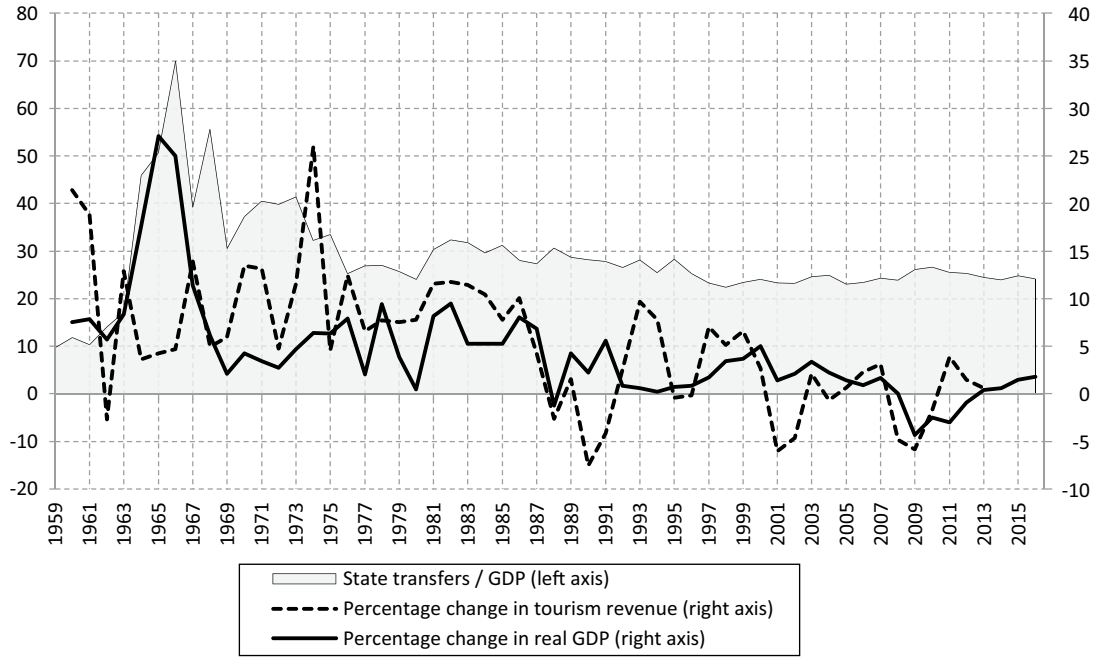
French Polynesia went into severe recession in 2009, which lapsed into economic depression[1]: real GDP fell by 10.2% between 2008 and 2012 according to the final accounts (ISPF, 2018). The magnitude of this depression, which saw the unemployment rate almost double, from 11.7% in 2007 to 21.8% in 2012[2] and the employment rate fall almost constantly from 53.0% to 44.1% over the same period, suggests that this phenomenon is more than a mere cyclical crisis. The hypothesis of a major structural crisis is underpinned by the observation of a deceleration in the real per capita growth rate between 2001 and 2007, which on average has dropped to virtually zero. The effects of 9/11 alone, as significant as they have been on the tourism sector, the territory's largest industry, cannot explain this drop in growth, as other Pacific Islands were able to recover quickly. It is true that the political instability experienced by the territory between 2004 and 2014, with no less than twelve changes of French Polynesia's President[3], has contributed to creating a climate that is unfavourable to growth, both in terms of public investment and investment by private companies. However, it can be observed that the deceleration began well before this period of political instability (Figure I). The arrival of the Pacific Testing Centre (CEP) in 1960 led to an explosion in economic growth for about a decade, with a doubling in the standard of living. However, it also marked the beginning of dependency on State transfers, which after reaching a peak of 70% of GDP in 1967, stabilised around 30% in the 1970s and 1980s. The first growth slowdown was observed in the late 1970s. A second deceleration in growth was seen from 1988, accompanied by a slight decline in the share of government transfers from the mainland to GDP. After the end of nuclear testing in 1995, rapid growth in international tourism in French Polynesia gave rise to hopes that a new economic driver would emerge. Nevertheless, while global tourism increased by 83% between 2000 and 2016, tourism in Tahiti and its islands fell by 23% over the same period (Boxes 1 and 2).

The hypothesis of a serious structural crisis has already been put forward, in particular

1. We use a common definition of economic depression: GDP decline that either exceeds 10% or lasts more than three years.
2. According to the five-year censuses of 2007 and 2012.
3. http://www.polynesie-francaise.pref.gouv.fr/layout/set/print/Les-elus/Le-President

Figure I
Economic growth, growth in tourism income and transfers from the State in French Polynesia (%)



Note: Due to the high volatility of data collected during the period 1960-1975 (Blanchet, 1984), the annual variation rate in real GDP is smoothed out using a 3-year moving average over this period.
Scope: French Polynesia, economy as a whole.
Sources: database built by authors based on the economic accounts of Insee (1960-1976), ITSTAT (1976-1996), the ISPF (1987-2014), and CEROM (2015-2016) (see box 3). Calculations by the authors.

in the conclusions of the General Assembly of the French Overseas Territories (2009), pointing out that the Polynesian economic crisis "*comprises both economic and structural factors*" and "*recessive trends can be interpreted as signs of a shortcoming in the growth model"* or in a report from Standard & Poor's (2010), stating that: *"the recession highlights the limits of the Polynesian business model"*. In this context, it appears necessary to take the analysis of these structural problems to a deeper level, by examining the determinants of growth in the Polynesian economy over an extended period, through a growth accounting

Box 1 – **The Pacific Testing Centre (CEP)**

In July 1962, French Polynesia was chosen as a testing site for French nuclear weapons. The Mururoa Atoll was designated as a firing field, with the Hao Atoll serving as an advanced base and the Tahitian island as the rear and administrative base of operations. Between 1966 and 1974, 46 air tests were carried out, followed by a series of underground tests under the lagoons of Mururoa and Fangataufa, i.e. 147 tests between 1975 and 1995. A moratorium was decided by President Mitterrand in 1992; then the tests resumed under the Chirac Presidency in 1995, before being definitively interrupted the following year.

Prior to the start of the CEP, the population was 100,000 inhabitants. The economy consisted mainly of primary production activities (coconut oil, coffee, vanilla, nacre, phosphate), export-oriented, and self-sustaining activities (fruit harvesting, fishing). In twenty or so years' time, this economy was brutally transformed under the effect of the CEP (see Blanchet, 1984; Poirine, 1996). Investment spending for the construction of transport infrastructure and logistics, in particular the construction of the Tahiti-Faa'a Airport, opened in 1961, as well as operating expenses, were huge. Personnel expenses were multiplied by a factor of 26 from 1962 to 1970 in military administrations and 9 in civil administrations (Blanchet, 1984, p. 37). French financial transfers to French Polynesia were multiplied by 10 during the same period, reaching almost 70% of GDP in 1966 (CEROM, 2007, p. 17). This explosion in spending was accompanied by a rapid increase in the number of companies present on the territory: in 1965, more than 1,000 companies were already working for the CEP (Blanchet, 1984, p. 32). Financial transfers from the State also came along with an influx of staff, technicians and civil servants. As in other countries, the rapid expansion of one sector in the specific economy came at the expense of other existing sectors (similar to the "Dutch syndrome" effect), in some cases causing their extinction (this was the case with phosphate mining in Makatea or coffee production). The contribution of the administrations to GDP almost tripled in the 1960s, from 12% to 34%, while that of small businesses fell by nearly half, from 60% to 33% during the same period (Blanchet, 1984, p. 37).

Box 2 – **The status of French Polynesia**

French Polynesia' status has evolved towards greater autonomy, from the overseas territories defined in the 1946 Constitution, in which the Governor remained responsible for drawing up and enforcing the decisions, until the organic law of 2004. The law of 6 September 1984 introduced the first autonomy status. New powers, particularly in the economic field, were granted to the territory in 1996. Lastly, French Polynesia, a French overseas territory (COM) since the 2003 constitutional review, gained common law powers in all areas not granted outright to the French State in 2004. The latter continues to hold power as regards nationality, electoral law, civil law, justice, foreign policy, defence, security and public order, currency and credit.

French Polynesia can define its own rules in all other areas, through acts of the General Assembly, including the "country laws", which remain subject to a litigation regime before the French Council of State. In an economy characterised by a wide range of opportunities for public authorities' intervention in economic life, autonomy status confers on the government and its President many discretionary powers in terms of subsidy allocation, investment control, in particular foreign investments, regulation of economic activities and action via public or semi-public companies – generally public institutions of an industrial and commercial nature (EPIC) and semi-public companies (SEM). The 2015 Report by the Laws Commission of the French National Assembly, presented by Jean-Jacques Urvoas, regrets "*the detrimental absence of assessment… of transfers of powers that might otherwise measure their relevance and efficiency*" (Urvoas, 2015, p. 79). It also stresses that powers continue to be exercised in an incomplete and imperfect manner (idem, p. 79).

In 1976, French Polynesia created the Institut Territorial de la Statistique (ITSTAT), which became in 1999 the Institut de la Statistique de la Polynésie française (ISPF), under the supervision of the Minister of the Economy of the local government. Its powers are, as is the case of ISEE (Institute of Statistics and Economic Studies) in New Caledonia, similar to those of a national statistics institute; only the five-year census of the population remains under the State's control via Insee (Insee, 2016).

exercise. In addition to the obvious interest of reconstructing long-term series on real GDP, real GDP per capita, the formation of capital, trends in the labour force and the accumulation of human capital, this makes it possible, above all, to highlight problems in labour productivity and total factor productivity (TFP), that is, the share of growth that is not explained by the increase in capital and labour volumes, for French Polynesia. TFP can be considered a measure of efficiency and technical progress, if measurement errors, in particular those regarding factor utilisation (for example, on the rate of production capacity utilisation and the hours worked per inhabitant) are not significant. The spotlight on TFP and its possible determinants should help explain why current growth is low and open up new prospects as regards economic growth policy.

This article offers, in the first section, a comparative analysis of trends in real GDP and real GDP per capita in French Polynesia compared with the rest of France over the long term. In the second section, a traditional growth model is used to analyse the contributions of the physical capital, human capital and labour factors, as well as TFP, to growth in French Polynesia. In the third section, analysis will focus on questions of productivity. A few explanations as to why TFP's contribution to growth continues to be low will be offered in the fourth section.

A comparative analysis of trends in real GDP and growth in French Polynesia and in France from 1960 to 2006

The comparison shown below between data on GDP growth in French Polynesia and those on mainland France (including overseas departments) may come as a surprise, considering the significant structural differences between the two economic spaces. The features specific to a remote island economy, such as Tahiti and its islands, that will be elaborated in the last section of the article, are a possible explanation for low performance in productivity. The comparison with France (including overseas departments) is nonetheless useful, at least as a benchmark for assessing Polynesian performance. It is furthermore justified by the fact that transfers from mainland France have for some thirty years amounted to between 20% and 30% of Polynesian GDP, that imports and technologies often come from mainland France, and that, more generally, many economic relationships exist between the two territories due to institutional, administrative and cultural ties (Box 3).

To take into account the latest change in national accounting system in French Polynesia, real GDP per capita is compared to that of France, initially between 1959 and

Box 3 – **Source and construction of the database for analysis of growth in French Polynesia**

The macroeconomic series required to analyse growth in French Polynesia over the long term have been reconstructed since 1959, sometimes by interpolation, due to the lack of data retropolation following methodological advances (implementation of new national accounting systems in French Polynesia in 1976 and 1987) and changes in database. To date, the last available final estimate of GDP is that of 2014 (ISPF, 2018) and the last early estimate dates back to 2016 (CEROM, 2017). However, due to a significant change in methodology since 2006, the series cannot be linked before and after the conformity-assurance measures taken to align with the SEC 95 European Accounting System, for which the base year was 2005[a]. This modernisation of accounting standards has resulted in significant differences between the old and new GDP values and components thereof for the transition year 2006. Thus, exports and imports of goods and services, which were respectively valued at 66.4 and 175.5 billion CFP francs according to the old methodology (ISPF, 2009), were re-estimated at 113.1 and 203.1 billion francs (resp. + 70.3% and +15.7%) following the switch to the SEC 95 standard (ISPF, 2012)[b] and the change in real GDP between 2005 and 2006 is 1.5% higher according to the new methodology (which relies on the ERETES information system[c]). Moreover, a GDP deflator was created while the old methodology used the consumer price index to move from current CFP francs to constant CFP francs.

More precisely, long-term series for GDP and other variables described below have been carefully constructed, to optimise their consistency, from the following sources:

- the series of nominal GDP, real GDP and its components are available from the annual economic accounts drawn up successively by the INSEE (from 1960 to 1976), ITSTAT (from 1976 to 1996), which became ISPF (from 1987 to 2006), and, since the adoption of the ESA 95, ISPF (final accounts from 2006 to 2014), and CEROM (early accounts for 2015 and 2016). The long-term series were built until 2006 by retropolation, starting from the earliest (1987-2006), and harmonising the base year (2005) using the short series published by Blanchet from 1960 to 1980 (1984) and by the IEOM (each year from 1971 to 1998); ➔

2006, then separately over the period from 2005 to 2011 in Figure II.

After very quickly catching up with the pack in the sixties, thanks to the arrival of the Pacific Testing Centre (CEP) dedicated to nuclear testing, and the very high public transfers from mainland France (with a peak at almost 70% of GDP in 1966, followed by an average of 30% until the end of the testing), which had the effect of profoundly transforming the economy and society, especially in Tahiti, Polynesian living standards grew less swiftly than in France until the end of the eighties. Moreover, the stagnation in GDP per capita in French Polynesia since the late 1980s can be seen clearly, as can the growing gap between GDP per capita on the mainland versus the territory, and more markedly still since the recent global crisis (+ 1% in France, from 2008 to 2016, compared with - 10% over the same period in French Polynesia). It is important to note that the two scales on this chart reflect the fixed exchange rate in effect (without any devaluation since 1949), while the cost of living is notoriously higher

Box 3 (contd.)

- tourism income shows total expenses in current CFP francs from international tourists (i.e., expenses by non-residents in French Polynesia). The data came from the biannual surveys carried out by the ISPF (from 1997), interpolated by the IEOM since 2007 for the balance of payments, and arithmetically by the authors between 1997 and 2007, as well as the estimations of the ITSTAT (the former name of the ISPF before 1999), between 1986 and 1996, estimates by Blanchet (1984) for the period between 1960-1980 and estimates of the authors from the linear interpolations of the ratio between tourist income and GDP between 1980 and 1985.

- transfers from the State are net, and calculated on the basis of the balance of payments debits and credits, estimated by the IEOM since 1998, and extrapolated from the IEOM's gross estimates (annual reports since 1980) between 1980 and 1997 and from Blanchet (1984), for the period 1960-1980, the latter being adjusted to obtain net values.

The recent global economic crisis has hit Polynesia hard, with real GDP, measured according to the new methodology, dropping by 4.2% in 2009, 2.5% in 2010, 3.0% in 2011, and 0.9% in 2012, for a total of 10.2%, that is higher than the threshold of 10% defining an economic depression, before slowly recovering and increasing by 0.4% in 2013, 0.6% in 2014 (final accounts), 1.5% in 2015 and 1.8% in 2016 (early accounts). In the absence of more precise data to estimate the causes of changes in productivity since 2007, we chose to limit our sample to the period 1959-2006 to analyse long-term growth until the crisis.

France's macroeconomic data covers mainland France and the overseas departments (DOM), excluding Mayotte, but does not include the accounts of local authorities and overseas territories. In the rest of this article, we will use the terms "France" and "mainland" to designate this economic entity, even though technically, it includes the overseas departments.

Origin of the data used:

- ISPF: Institut de la Statistique de la Polynésie Française (since 1999, formerly known as ITSTAT, Institut Territorial de la Statistique de la Polynésie Française - http://www.ispf.pf/ISPF)

- Insee: French National Institute of Statistics and Economic Studies (see Economic Tables from 1960 to 1976)

- IEOM: Institut d'Émission d'Outre-Mer (see Annual Reports or Balance of Payments Reports)

- IMF: International Monetary Fund (see International Financial Statistics)

- World Bank (see Global Development Indicators)

Data have also been excerpted from the following articles and/or works: World Bank (2010), Barro and Lee (2013), Blanchet (1984), Dropsy *et al.* (2007), Dropsy (2007), Kamps (2006), Poirine (2011, 1996).

Box notes:

(a) http://www.ispf.pf/themes/EconomieFinances/Comptesconomiques/Publications.aspx

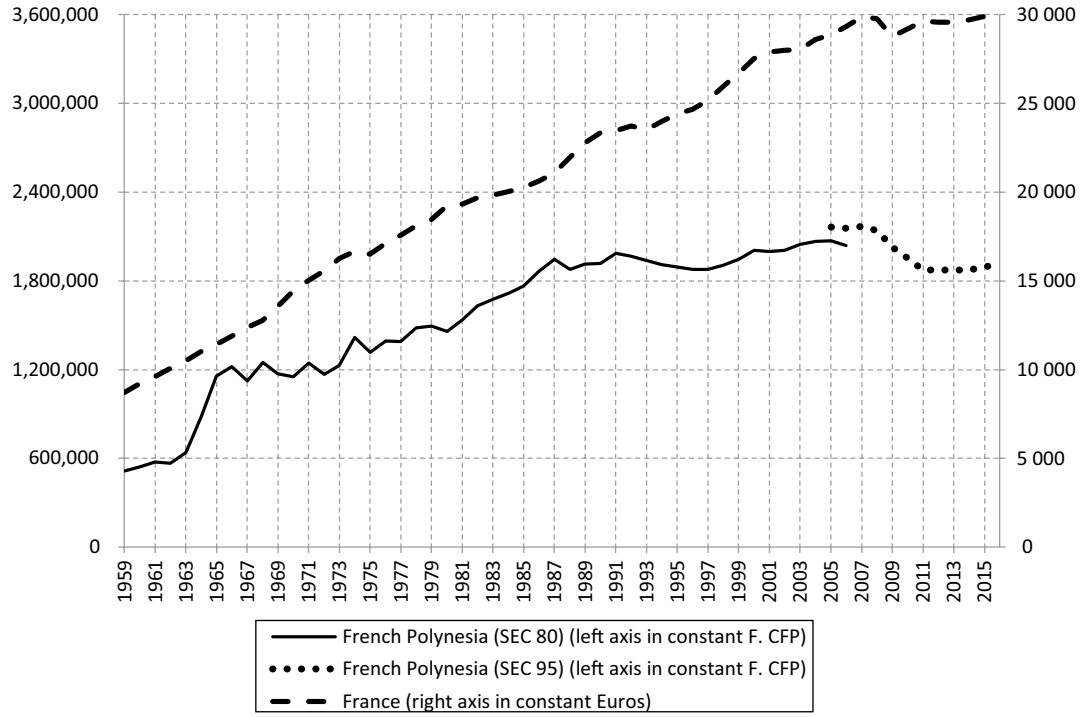
(b) According to the old Polynesian standard before 2006, exports of goods and services were defined as the sum of the exports of goods, extracted from the data provided by the customs services then adjusted, and tourism expenses, taken from a biannual survey carried out by ISPF.
http://www.ispf.pf/bases/Repertoires/CommerceExterieur/Prsentation.aspx
http://www.ispf.pf/bases/Tourisme/EDT.aspx
According to the new standard, exports and imports of goods and services also include balance of payments data provided by the IEOM, in particular services excluding travel that were not previously taken into account.

*(c) ERETES is "*a support module for the establishment of National Accounts in compliance with international standards of the SCN 1993*", the owners of which are Eurostat, the French Cooperation represented by INSEE and the user countries represented by the Brazilian Institute of Geography and Statistics, IBGE (*Instituto Brasileiro de Geografia e Estatística*). Data preparation consists of the following steps: (i) set up a loading table specific to ERETES for each of the national accounting sources, before incorporating the accounting information into the database; (ii) balance resources and jobs in the economy for each product/service; (iii) compare and contrast intermediate consumption (IC) from ERE with IC demand that comes concurrently from fiscal sources, EAE and administration accounting data; (iv) derive a balanced inter-industry exchange table (IET) based on these trade-offs; (v) determine the level of GDP, and balance out the inter-agent matrices that make it possible to obtain a balanced table of integrated economic accounts (TCEI).*

in French Polynesia, which accentuates the difference in purchasing power with France. For guidance purposes, a study by the ISPF (2016) estimates an additional cost of 55% for a representative shopping basket purchased in this French overseas collectivity, compared to the mainland area in 2016. On the other hand, the same study compares the cost of a representative shopping basket in mainland France for the Polynesian consumer, which would be 19% lower than in French Polynesia. According to international standard practice, a Fisher-type index, i.e. a geometric average of the two Laspeyres indices representing price differences for each basket, is used to offer a symmetrical measure of the difference in price levels between the two territories. In our case, this Fisher index is equal to $1.39 = (1.55*0.81)^{1/2}$, i.e. a difference in price level of 39% in 2016. Thus, the GDP per capita of French Polynesia (2.121 million f. CFP) in 2016, equal to 52% of that of metropolitan France (€34,342) at the official exchange rate (1000 f. CFP = €8.38), would in fact be only 37% (= 52% / 1.39) of the mainland standard of living at comparable prices.

Table 1 shows the averages of real GDP, real GDP per capita and their growth rates for different periods between 1960 and 2006 for French Polynesia and France. The first oil shock is a turning point in the global economy, marking the end of the first period (1960-1973) of sharp growth amounting at 6.5% real GDP per capita in French Polynesia, even though the "CEP boom" was felt above all in the sixties. Then, French Polynesia and France experienced high inflation rates from 1974 until the mid-eighties. The end of the second period, 1974-1987, represents a turning point in the Polynesian economy – whereby the 23 October 1987 riots were symptomatic of economic and social malaise – with annual growth of real GDP per capita reduced by half to 3.3% per year. The third period, from 1988-1996, saw this growth fall sharply to become negative (- 0.4% per year), partly due to uncertainties about the Polynesian economic model at the end of the nuclear tests in 1992 and the riots in 1995 following the announcement of their brief restart. The fourth period, from 1997-2000, is one of strong rebound in tourism, particularly from the United States, and even more

Figure II
Real GDP per capita in French Polynesia and France



Note: real GDP per capita in French Polynesia is stated in constant CFP francs, base 2005.
Scale 1000 F. CFP = €8.38.
Scope: French Polynesia and France (mainland France and overseas departments, excluding Mayotte), economy as a whole.
Sources: For French Polynesia: database built by the authors based on Insee's economic accounts (1960-1976), ITSTAT (1976-1996), ISPF (1987-2014), and CEROM (2015-2016); authors' estimates. For France: Insee, national accounts, temporary 2016 (base 2010).

so of development for private productive infrastructures and equipment, as well as a strong expansion in the construction sector, which increased its contribution to GDP from 6.3% in 1995 to 7.9% in 2000. This resulted in a particularly dynamic Polynesian economy, with real per capita growth of 1.7% per year. Finally, the last period, from 2001 to 2006, saw the Polynesian economy fall into the doldrums, with zero growth in standard of living, after the fall in tourism and its stagnation, as well as political instability from 2004.

Figure III illustrates the comparison of GDP growth per capita in French Polynesia and France, period by period. The arrival of the CEP in the sixties, which created a real "economic shock", doubling the average purchasing power of Polynesians in ten years or so, enabled rapid catch-up in living standards, thanks to a positive gap of almost 2% in annual growth compared with France. Over the next two decades, the average growth rate weakened, but was still enough for the Polynesian standard of living to double. The economic catch-up with France continued after the oil crisis, thanks to growth exceeding the mainland rate by 1.5% in the second period ending in 1987. Since that year and up to 2006, the Polynesian economy has seen its real GDP per capita near-stagnating, despite a brief upturn in 1997-2000, while that of France grew by 40% over the same period. While the latter has implemented structural macroeconomic policies supporting the continuation of European integration (developing competition, privatisation, more direct taxation, etc.), French Polynesia, which has enjoyed new autonomous status since 1984 with a very high degree of flexibility in terms of fiscal, social and economic policies, has not benefited directly from the same structural adjustments.

Observable growth factors in French Polynesia: capital, labour, human capital

The accounting decomposition model (Box 4) can be used to calculate the respective contribution of the observable growth factors – capital, labour and human capital – and that of TFP.

The accumulation of capital and investment dynamics

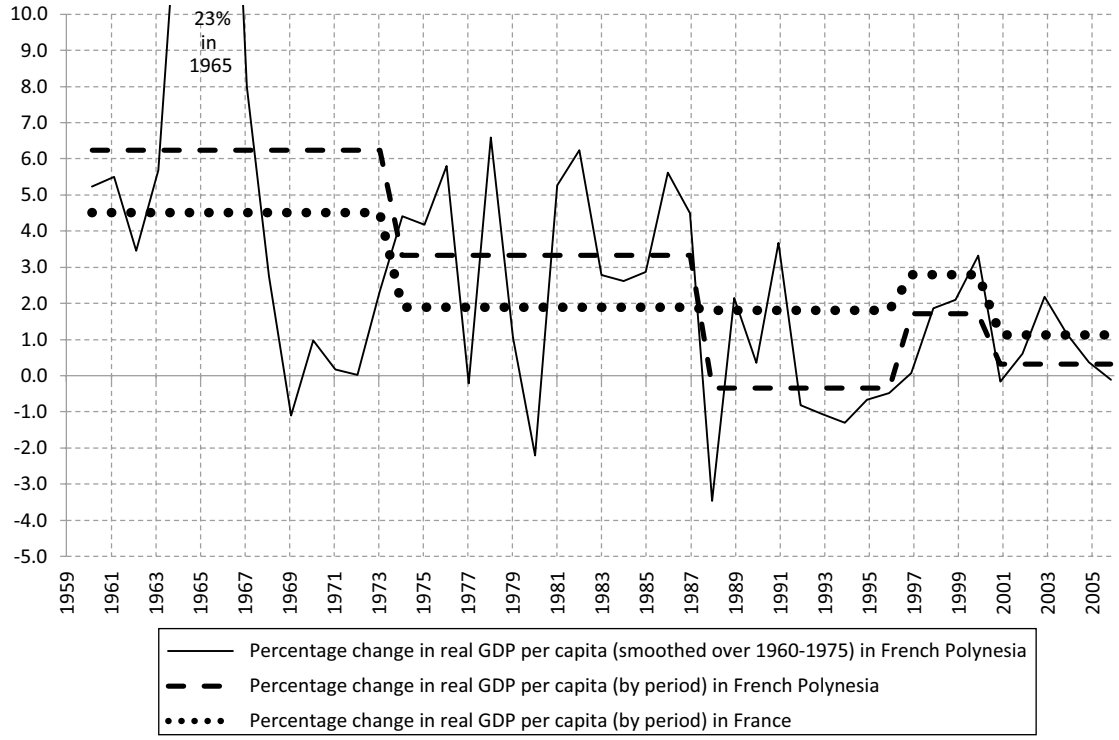
The accumulation of capital is linked to savings and the expected profitability of its productive use in investment. This profitability itself depends on various factors that are more or less controllable locally. Growth and development specialists stress the importance of creating and maintaining a "climate conducive to investments", referring to a set of factors that can be classified in three

Table 1
Standard of living and economic growth, French Polynesia and France

Average (in millions of f. CFP at constant 2005 prices)					
	1960-73	1974-87	1988-96	1997-2000	2001-06
French Polynesia					
Real GDP	106,764	246,540	391,397	442,944	506,010
Real GDP per capita	0.99	1. 58	1. 92	1. 93	2. 04
Average annual growth rate (%)					
	1960-73	1974-87	1988-96	1997-2000	2001-06
French Polynesia					
Real GDP	9.8	6.2	1.6	3.5	1.7
Real GDP per capita	6.5	3.3	- 0.4	1.7	0.3
France					
Real GDP	5.5	2.4	2.2	3.3	1.8
Real GDP per capita	4.5	1.9	1.8	2.8	1.1

Scope: French Polynesia and France (mainland France and overseas departments, excluding Mayotte), economy as a whole.
Sources: For French Polynesia: database built by the authors based on Insee's economic accounts (1960-1976), ITSTAT (1976-1996), ISPF (1987-2014), and CEROM (2015-2016), base 2005; authors' calculations. For France: Insee, national accounts, 2016 provisional.

Figure III
Per capita economic growth in French Polynesia and France (%)



Note: Due to the high volatility of data collected during the period 1960-1975 (Blanchet, 1984), the annual variation rate in real GDP is smoothed out using a 3-year moving average.
Scope: French Polynesia and France (mainland France and overseas departments, excluding Mayotte), economy as a whole.
Sources: For French Polynesia: database built by authors based on the economic accounts of the Insee (1960-1976), ITSTAT (1976-1996), ISPF (1987-2014), and CEROM (2015-2016); authors' calculations. For France: Insee, national accounts, 2016 provisional.

Box 4 – **Accounting breakdown of GDP growth per capita**

Quite traditionally, as in the various growth accounting exercises, we are framing the analysis within a growth model inspired by Solow (1956) and Mankiw. *et al.* (1992). We assume, for the sake of simplicity, that the territory's production (GDP) can be represented by a Cobb-Douglas function with constant returns. GDP, Y, is then based on the use of capital factors, K, labour, L, and human capital H incorporated into labour, and a residual factor A, total factor productivity (TFP), which represents the effect of technological changes, but also a set of other factors such as the functioning of the markets, the organisation of work or public governance. We adopt a specification where human capital H enters the production function by increasing the contribution of the labour factor, i.e. $H = hL$, with h being the quantity of human capital per worker (see for example Barro and Lee, 2013; Weil, 2005, p. 172).

Under these assumptions, production is described as:

$$Y = AK^{\alpha} (hL)^{1-\alpha} \quad (1)$$

where, given the assumption of constant returns, the coefficients α and $(1-\alpha)$ represent, respectively, the share of capital and labour in territorial income. In the absence of data on the shares of labour and capital in added value in French Polynesia, the value of the coefficient α is assumed to be similar to that of mainland France and taken equal to 30%, the average value estimated by Pionnier (2009) for France over the period 1949-2008, and used by Bergeaud *et al.* (2014, 2016).

The variable h is approached based on the number of years of schooling per worker, taking into account the expected return on investment in years of additional studies. Other indicators, such as enrolment rates at school, literacy rate, national education expenditure and income expectancy, can be used to estimate human capital (Liu & Fraumeni, 2014); our choice was made in light of the reduced availability of these data, first, and the relevance of the variable chosen, second. According to a method that has now become common (Barro & Lee, 2013), human capital is linked to years of studies as follows: $h = exp^{(\theta.E)}$, where E represents the average number of years of schooling in the population aged 15 and over, and θE represents the efficiency of a working unit having accumulated E years of schooling.

By expressing the Cobb-Douglas function per worker ($y = Y/L$), the equation (1) becomes:

$$y = Ak^{\alpha}h^{1-\alpha} \quad (2)$$

→

categories: 1) macroeconomic policy and foreign trade policy, 2) infrastructures and 3) governance and institutions (Weil, 2005; Stern *et al.*, 2005).

In French Polynesia and for several years, many of the factors defining investment climate have not been conducive to growth. Political instability, which was high between 2004 and 2013, has created uncertainties unfavourable to investment, but it affected only the very last part of the period studied. In the longer term, the strong local protectionism, mistrust of foreign direct investment, and nervousness of local investors are probably as many obstacles to the overall dynamism of the economy and, consequently, to investment.

As regards infrastructures, French Polynesia has certainly invested heavily in urban planning and transport during the years of the CEP, but this type of investment has since slowed down. The dynamic of investments in French Polynesia reflects the difficulties resulting from this unfavourable climate. Figure IV shows that the investment and capital to GDP ratios (Box 5) follow an explosive trajectory in the sixties connected with the CEP, then start a decreasing trend since the start of the 1980s (following the reduction in the number of nuclear tests), contrary to the national trend shown in comparison, despite the various tax incentives.

Table 2 shows the annual growth rates of net capital stock to employment ratios, distinguishing between the public and private sectors. The impact of the massive investments connected with the arrival of the CEP and the different airports in the 1960s can be very clearly seen here, with an annual increase in public capital stock by public employment of 16.4% per year during the first period, declining during the following periods. Likewise, the magnitude of private investment led to a rapid increase in the real net private capital stock by private employment during the first two periods, before plummeting between 1987 and 2000, followed by a stagnation since the start of the new millennium (the increase in private investment being offset by an increase in employment).

The labour factor and demography

The rise in the labour factor is due to demographic changes, first the natural change, and secondly migration, in both directions, between French Polynesia and foreign territories. The total population grew at a high annual rate and more than doubled between 1960 and 1987, growing more slowly thereafter and up to the present time. Table 3 presents key data on the population, employment and their growth.

The share of public employment is 28% on average (12% corresponding to State employment), a relatively stable ratio from the 1960s up to 1996, at which point a temporary increase in the proportion of private-sector jobs was seen into the late 1980s, followed by a return to the long-term average.

The employment rate of people between ages 15 and 64 is very low in French Polynesia, compared with other territories or countries, at around 53% in 2007, before the onset of the crisis, compared to 63.7% in France in

Box 4 (contd.)

In logarithmic terms, equation (2) becomes:

$$\text{Log}(y) = \text{Log}(A) + \alpha\text{Log}(k) + (1-\alpha)\text{Log}(h) = \text{Log}(A) + \alpha\text{Log}(k) + rE \quad (3)$$

with $(1-\alpha)\text{Log}(h) = (1-\alpha)\theta E$, and where $r = (1-\alpha)\theta$ represents the marginal effect of an additional year of study E on real GDP per worker, i.e. the semi-elasticity of labour productivity relative to the level of education. Consequently, the growth rate of real GDP per capita (y) is proportional to the rate of technical progress (A), to the rate of variation in the capital ratio per employee (k), and to increases in level of education (E) across the population. The educational return parameter r is assumed to be equal to 7%, in the middle of the range of microeconomic estimates (between 6% and 8%), according to the estimates from Bergeaud *et al.* (2018).

Equation (3) makes it possible to estimate the TFP, i.e. the residual factor A, after setting the parameter values for α and r:

$$\text{Log}(\text{PGF}) = \text{Log}(y) - 0.3\text{Log}(k) - 0.07E \quad (4)$$

the same year (Venayre, 2009). This low level reveals the existence of substantial potential for productive use of the labour factor, which could contribute to growth, if the required investments were made.

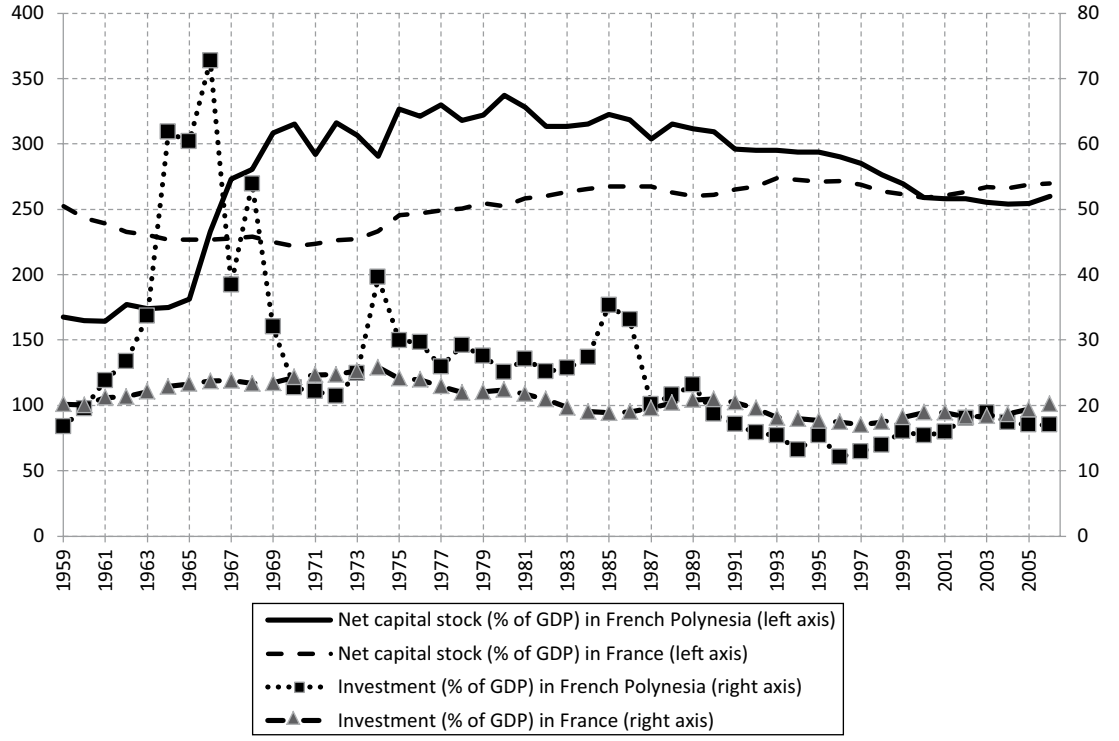
The accumulation of human capital

While human capital is defined by the OECD (2001c; 2007) as "the knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being", the "proxy" variable used to estimate human capital per worker ("*h*" in equations 1 and 2 of box 4) is the average number of years of schooling (*E*) for the population ages 15 and above, according to the methodology defined by Barro and Lee (2013)[4].

French Polynesia has made significant efforts to attain the objective of increasing enrolment, accompanied by increasingly high degrees, thereby accumulating human capital. For the

4. *http://www.barrolee.com.*

Figure IV
Net capital stock and investment in French Polynesia and France (% of GDP)



Scope: French Polynesia and France (mainland France and overseas departments, excluding Mayotte), economy as a whole.
Sources for French Polynesia: Database built by the authors based on Insee's economic accounts (1960-1976), ITSTAT (1976-1996), ISPF (1987-2014), and CEROM (2015-2016), (see boxes 3 and 5); authors' calculations. For France: Insee, national accounts, 2016 provisional.

Table 2
Average annual growth rate of real net capital stock to employment ratios in French Polynesia

(%)

	1960-73	1974-87	1988-96	1997-2000	2001-06
Real net capital stock to total employment ratio	10.8	3.9	- 1.0	- 2.1	- 0.2
Real net capital stock to public employment ratio	16.4	1.2	- 0.5	- 0.8	- 1.4
Real net private capital stock to private employment ratio	6.9	6.4	- 1.3	- 2.9	0.1

Scope: French Polynesia, economy as a whole.
Sources: Database built by the authors based on Insee's economic accounts (1960-1976), ITSTAT (1976-1996), ISPF (1987-2014), and CEROM (2015-2016), (see boxes 3 and 5); authors' calculations.

Box 5 – **Reconstructing series of capital stock**

A series of capital stock K is reconstructed, first for French Polynesia and secondly for France, using the same permanent inventory method (OECD, 2001a, Chapter 5; 2001b, p. 89-91; 2009, p. 127-133; 2013):

$$(1)\ K_t = I_t + (1- \delta)\ K_{t-1}$$

where I represents investment (gross formation of fixed capital) and δ the depreciation rate.

By recursive substitution, we obtain:

$$(2)\ K_t = (1- \delta)^t K_{1+} \Sigma^{t-1}_{i=0} (1- \delta)^i I_{t-i}$$

where the initial stock of capital K_1 is determined (OECD, 2009, p. 131) by:

$$K_1 = I_1 / (\delta+g_I)$$

with g_I annual rate of real growth in investment in the long term.

Piketty and Zucman (2014, pp. 1264-1265) criticise the use of this methodology and recommend the use of national balance sheets to estimate income wealth ratios between 1970 and 2010 for eight economies, or even from 1870 for Germany, 1770 for the United States, and 1700 for France and the United Kingdom.

However, the ratio of fixed capital consumption (i.e. the depreciation suffered by fixed capital) to GDP is relatively similar and stable for French Polynesia and for France, around 12% to 14% for the last three decades. In contrast, the ratio of national wealth to GDP in France is on average equal to 3.7 from 1970 to 1999 before increasing very sharply to reach 6 in 2009, while the ratio of net capital to GDP increases from 2.3 to 2.8 from 1970 to 1979 before stabilising until 1999, and increasing slightly to 3.1 in 2009. In any case, as national balance sheets are not available for French Polynesia at such a disaggregated level as for France, it is not possible to replicate the Piketty and Zucman methodology for French Polynesia.

The change in net capital is equal to the net formation of fixed capital, i.e. domestic investment (gross formation fixed capital) minus depreciation (fixed capital consumption), the rate of which is estimated at 5% on average for France and for French Polynesia (World Bank 2010, p. 143). The net initial capital stock (initial investment divided by the sum of the depreciation and real growth rates), respectively for France and French Polynesia, is estimated based on the average depreciation rate of 5% and the average growth rate, 3% for France and 5% for French Polynesia respectively.

In this regard, Bergeaud *et al.* (2016) estimate the depreciation rate of equipment at 10% and that of buildings at 2.5%. We do not have any disaggregated investment data for these two types of assets in the long term. However, recent data (since the change in methodology of economic accounts in 2006) make it possible to conclude that the share of equipment and construction and public works in the total FBCF has been approximately equal for some years, but without any indication for the preceding decades. Assuming that this split is more or less constant over time, which is very unlikely, given the economic shock of the C.E.P. in the 1960s, the average depreciation rate for equipment and buildings would be 6.25%, a rate close to the overall rate of depreciation applied (5%). With these parameters, the ratio of net capital stock to GDP is estimated on average over the period 1960-2006 at 2.6 for France and 2.8 for French Polynesia.

Table 3
Demography and employment *L* in French Polynesia

Annual average per period					
	1960-73	1974-87	1988-96	1997-2000	2001-06
Total population *	104,143	154,307	203,933	228,925	248,083
Total employment L**	36,194	53,238	68,621	80,001	89,722
Public employment ***	10,219	15,031	19,360	21,030	25,779
Private employment ****	25,975	38,207	49,261	58,971	63,943
Average annual growth rate (as %)					
	1960-73	1974-87	1988-96	1997-2000	2001-06
Total population *	3.3	2.7	2.0	1.8	1.5
Total employment L**	3.3	2.4	2.1	3.0	2.0
Public employment ***	3.3	2.4	2.0	1.4	3.4
Private employment ****	3.3	2.4	2.1	3.5	1.5

Note: * data interpolated between censuses; ** active workers with a job in the sense of the census; *** public sector employees (local authority, municipalities, State); **** salaried employees in the private sector and non-salaried staff.
Scope: French Polynesia, economy as a whole.
Sources: ISPF, High Commission; authors' calculations.

purposes of growth accounting, the average level of human capital of the working population was calculated based on the average number of years of schooling in the population ages 15 and above: it doubled between 1960 and 2006, increasing from 3 years in 1960 to 6 years in 2006. Table 4 illustrates this progression. However, there was a slowdown in this accumulation of human capital in the second half of the 1990s. Appendix 2 makes it possible to analyse the robustness of the TFP calculation in French Polynesia and its gap with France with respect to hypotheses on the calculation of level of education *E*.

Labour productivity and total factor productivity

Equation (2) in box 4 reflects the GDP per person employed, *y*, as a function of capital, labour, human capital and TFP. The variable *y* corresponds to a simple definition of labour productivity, which, as can be seen in equation (3), depends on TFP and capital intensity *k* and quality of work (linked to human capital). Figure V shows the trend in labour productivity in French Polynesia, compared with France, bearing in mind the overvaluation of the CFP Franc, which tends to significantly underestimate the real gap between the two territories.

This figure shows a very rapid increase in labour productivity at the start of the 1960s, following the CEP shock, then a far more modest trend over the next two decades. From the start of the 20th century, a decline in labour productivity can be seen, followed by a slight rebound in 1997, and a further decline after 2003.

Differences between changes in annual growth rates in labour productivity in the public and private sectors can also be seen in Table 5. Public sector labour productivity, after a very sharp increase in the 1960s, has been growing at lower rates than those observed in private-sector since 1973. Moreover, labour productivity in the public sector, apart from a brief period in the late 1980s, has fallen since 1988 while it is on average increasing slightly in the private sector since 1997.

The issue of low labour productivity in French Polynesia (in level and in growth rate) had been discussed in a CEROM study (2007, pp. 104–106). It was noted that labour productivity in Polynesia, measured by the ratio of market value added to private employment, was in line with the average for French overseas departments, but declined significantly between 1995 and 2003, contrary to what was noted in other French overseas departments or territories. Although the analysis of this ratio itself offers a wealth of lessons, we prefer to focus on total factor productivity, as a rise in labour productivity, measured by the ratio Y/L, disregards any possible changes in human capital H and physical capital K. It can therefore hide a capital increase K made available to workers, or for instance the increase in their human capital.

Table 4
Stock of human capital in French Polynesia and France (educational attainment *E* measured by the number of years of schooling in the population aged 15 or over)

	1960-73	1974-87	1988-96	1997-2000	2001-06
In level (annual average per period)					
France	4.7	6.2	7.9	9.3	9.8
French Polynesia	3.0	4.2	5.2	5.4	5.6
Variation (average annual growth rate, in logarithmic difference, per year)					
France	1.7	2.0	2.4	2.1	0.8
French Polynesia	2.9	2.0	1.7	- 1.1	2.4

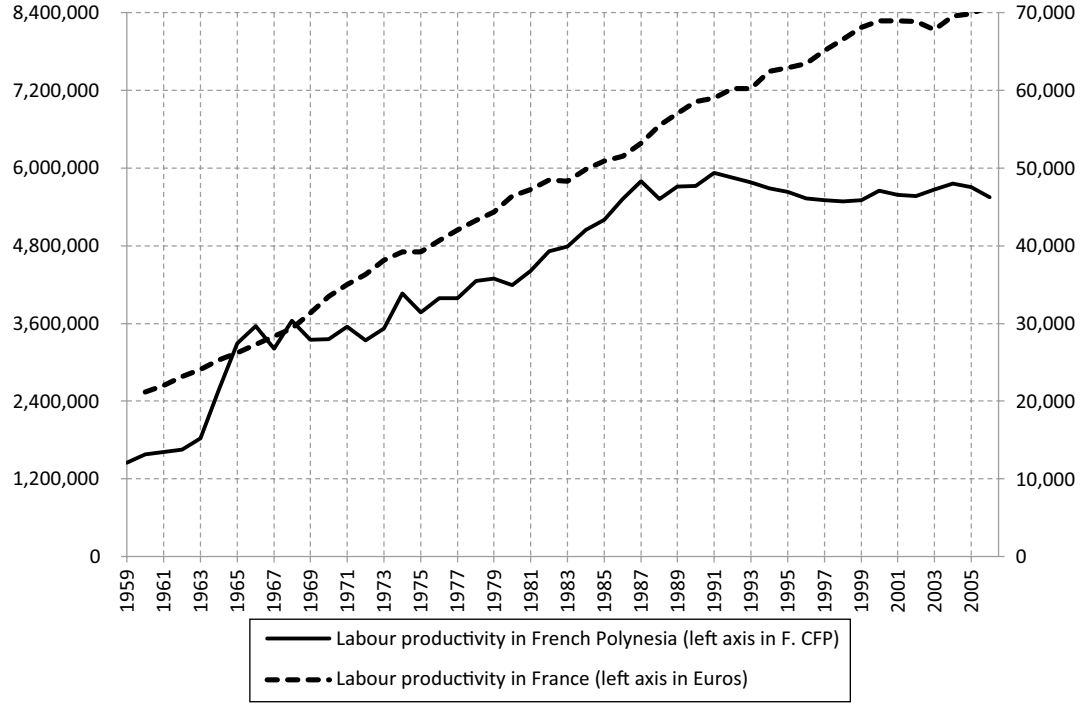
Note: For France, estimates are based on Barro and Lee (2013). The average number of years of schooling is set at 5 for non-graduates (i.e. early childhood education), 9 for graduates of a French CEP or BEPC (i.e. lower secondary education), 11 for a French CAP or BEP (i.e. upper secondary education), 12 years for a French Baccalaureate (i.e. high-school degree), 15 years for a first-cycle diploma (i.e. bachelor's degree), 17 years for a second-cycle diploma (i.e. master's degree). For French Polynesia, data is interpolated between censuses. The average number of years of schooling was calibrated to replicate the level of education between French Polynesia and France estimated at 3.3 years (average from 2004 to 2006) based on the respective data of ISPF and the State of Higher Education and Research, using the methodology of Barro and Lee (2013).
Scope: Population aged 15 or over, French Polynesia and France (mainland France and overseas departments, excluding Mayotte).
Sources: ISPF (census data) for French Polynesia; the State of Higher Education and Research for France; authors' calculations (see Box 4 and Appendix 2).

TFP estimation for the period 1960-2006

We present below the key results concerning the estimated TFP trend over the period 1960-2006 based on the growth breakdown equation (3) (see Box 4), particularly with a coefficient α (share of capital) estimated at 30% and a coefficient r (marginal effect on real GDP growth rate of one additional year of study *E)* estimated at 7%, according to the hypotheses and estimates by Bergeaud *et al.* (2018). The robustness of this estimate is verified by varying the values of both parameters α and r (Appendix 1). Table 6 shows the breakdown in annual growth rates of real GDP per period.

Real GDP growth, at nearly 10% per year during the first period, corresponds very well to the explosion in government spending in French Polynesia (GDP from non-market sector showing an increase of 15% annually) for the construction of the airport in Tahiti and the CEP infrastructures, hence a rapid increase in capital stock, which contributes more than

Figure V
Labour productivity in French Polynesia and France



Note: Real GDP per inhabitant in French Polynesia is stated in constant CFP francs, base 2005.
Scale 1000 F. CFP = €8.38.
Scope: French Polynesia and France (mainland France and overseas departments, excluding Mayotte), economy as a whole.
Sources: For French Polynesia: database built by authors based on the economic accounts of Insee (1960-1976), ITSTAT (1976-1996), the ISPF (1987-2014), and CEROM (2015-2016). For France: Insee, national accounts, 2016 provisional.

Table 5
Average annual productivity growth rate of French Polynesia

(%)*

	1960-73	1974-87	1988-96	1997-2000	2001-06
Public and private labour (L)	6.4	3.6	- 0.5	0.5	- 0.3
Public sector labour	15.1	2.0	- 0.6	0.3	- 1.5
Private sector labour	4.1	4.3	- 0.5	0.6	0.2

Note: * Annual percentage change in real GDP by type of employment, total, public or private (see Table 3).
Scope: French Polynesia, economy as a whole.
Sources: ISPF, High Commission; authors' calculations.

one-third of growth. It can be noted that the labour factor (+ 2.9%) and TFP (+ 2.4% per year) also contributed significantly to growth during this period.

Over the following period, from 1974 to 1987, the pace of growth slowed, though still remaining high. Real GDP grew faster in the private sector than in the public sector during this period, following the stabilisation of the government's financial transfers to around 30% of GDP. The labour factor is contributing significantly to growth, while the contribution of capital is slowing down. TFP still contributes significantly to growth, at 1.8% per year. The accumulation of human capital contributes on average to 0.6% across all these periods.

Between 1988 and 1996, GDP growth declined to 1.6% per year on average. Only the labour factor and human capital contributed positively over this period, where capital accumulation played a negative role (- 0.3%), as did TFP (- 0.8% per year).

The return of growth seen during years 1997-2000 came through the expansion of the sectors developing the territory's own resources (tourism, fishing, pearl culturing), both under the impetus of public policies and international demand favourable to these products. It should be noted that this growth was mainly based on the contribution of the labour factor, while TFP contributed significantly with an average of 1.6% per year.

Lastly, over the last period (2001-2006), growth slowed again (annual rate of 1.7%), due to cumulated difficulties in the three driving sectors, tourism, fishing and pearl culturing. Growth is still supported by the contribution of the labour factor and the contribution of human capital; however, the contribution of TFP became negative (- 1.2% per year on average). Figure VI shows the trend in TFP in French Polynesia. It points out the drop in Polynesian TFP's progression compared with TFP in France, from the end of the 1980s.

Cyclical fluctuations in economic activity in French Polynesia do not always lead to immediate adjustments on the labour market, particularly in the sectors protected from competition. Thus, in the unfavourable phases of the cycles, the observed decreases in TFP can be interpreted as the consequences of delayed or even non-existent adjustments in employment rather than actual losses in technological progress. While this mechanism is well known (see for example Fernald, 2014), the conditions of the Polynesian economy are likely to worsen its scope.

However, these cyclical adjustments cannot explain the chronically low TFP or even

Table 6
Estimation of total factor productivity (TFP) for French Polynesia

Breakdown of annual real GDP growth rate (in logarithmic difference, per year*)					
	1960-73	1974-87	1988-96	1997-2000	2001-06
Real GDP growth rate (Y)					
Real GDP (Y) (public and private sectors)	9.3	6.0	1.6	3.5	1.7
Public sector real GDP	15.3	4.4	1.5	1.7	1.9
Private sector real GDP	7.5	6.6	1.6	4.0	1.6
Contribution of factors and TFP to real GDP growth rate (public and private) (percentage points)					
Labour (L) **	2.9	2.4	2.1	2.9	2.0
Capital stock (K)***	3.3	1.2	- 0.3	- 0.7	- 0.1
Human capital (E) ****	0.6	0.6	0.6	- 0.4	1.0
PGF *****	2.4	1.8	- 0.8	1.6	- 1.2

Notes: * the real GDP growth rate is stated in logarithmic difference in this table and can therefore differ from the real GDP growth rate in Table 1. ** Contribution of the change in number of active workers with a job (in the public and private sectors) to real GDP. *** Contribution of the change in real net capital stock to real GDP. **** Contribution of the average number of years of schooling in the population ages 15 and above to real GDP. ***** TFP estimated from equation (4) $\text{Log}(TFP) = \text{Log}(y) - 0.3\text{Log}(k) - 0.07E$ (see Box 4).
Scope: French Polynesia, economy as a whole.
Sources: ISPF, High Commission; authors' calculations and estimates.

negative contributions to growth over multiple years. The comparison with the evolution of TFP in France is enlightening in this regard. While France's TFP almost doubled (+99%) from 1960 to 2006, French Polynesia's TFP increased much less significantly: 64% over the same period, i.e. barely more than in 1960-1965 (+ 59% in 1965 compared with 1960) and less than during the 1987 peak (+ 77% compared with 1960).

France, which remains French Polynesia's leading economic partner, with 27% of its trade in goods and 56% of its current transactions (notably thanks to the large transfers from the State) in 2016, also saw its TPF go off course and stagnate, but only from 2003-2004 (Cette *et al.*, 2017), much later than the Polynesian decline and desynchronization in the early 1990s.

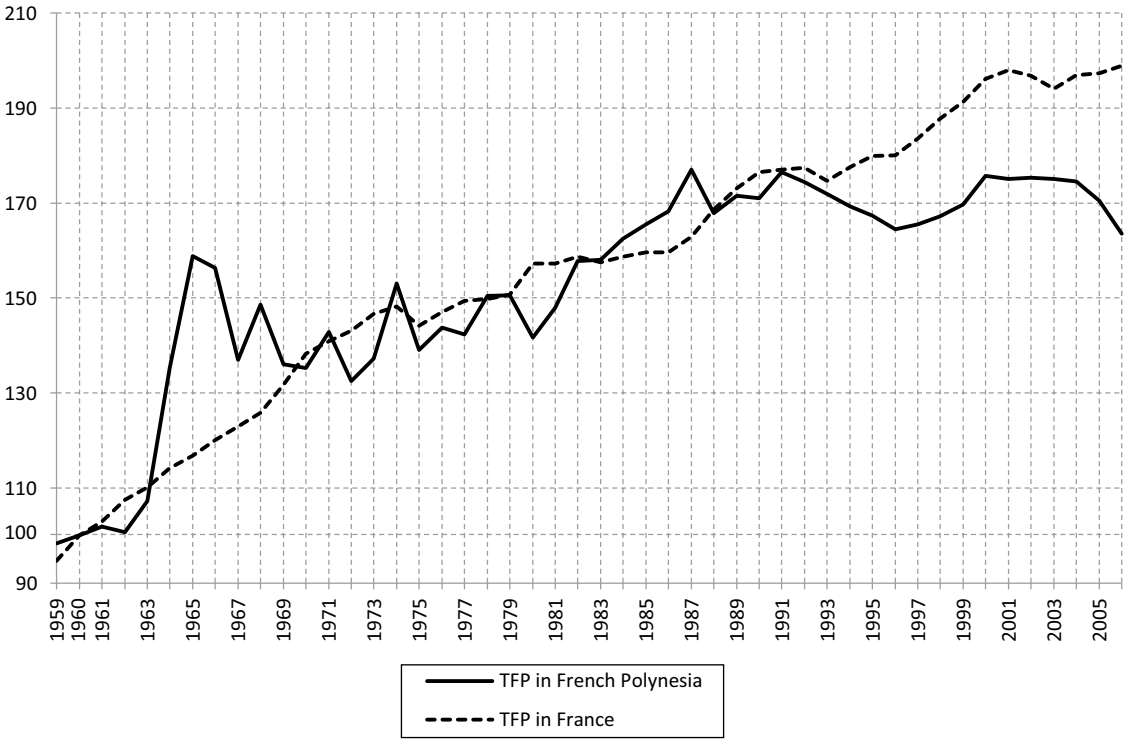
What can be inferred from the weak TFP growth in French Polynesia over the long-term, particularly since the end of the 1980s? Could virtual stagnation or even a negative trend in TFP be inevitable given the territory's geographical, commercial and institutional conditions?

Understanding low total factor productivity in French Polynesia

Total factor productivity is, much like the accumulation of physical and human capital, a direct determinant of growth, but is also an endogenous element. The deeper determinants are geographical conditions, the trade environment and the institutions. To fully understand the evolution of TFP would thus require an in-depth study of its connection with these more fundamental factors. The data available to researchers do not currently enable such work to be carried out. However, some avenues can be suggested here in addition to the comments on the results presented previously.

The question raised bears an analogy with the one discussed abundantly over the past few

Figure VI
Total factor productivity in French Polynesia and France



Scope: French Polynesia and France (mainland France and overseas departments, excluding Mayotte), economy as a whole.
Sources: For French Polynesia: database built by the authors based on Insee's economic accounts (1960-1976), ITSTAT (1976-1996), ISPF (1987-2014), and CEROM (2015-2016); authors' estimates based on equation (4) (see Box 4). For France: Insee, Annual National Accounts, 2016 Provisional (2010 basis). Authors' estimation using the same methodology and with the same values for α and r for French Polynesia.

years on the slowdown in total factor productivity and the possibility of a long-term trend toward reduced growth rate, or even stagnation, in the most advanced countries (on this question, see authors such as Gordon, 2015 or Summers, 2015). This discussion pertains mainly to the slowdown in growth observed since the mid-2000s. Various explanations have been offered, in particular, that the returns enabled by existing new technologies have reached an end, due to difficulties in extending their penetration and a slower pace for both innovation and improvement in new technologies. In the case of French Polynesia, our analysis focuses more on the early part of the 1990s.

There is broad consensus that the determinants of productivity growth are linked to incentives for firms and the business environment in which they operate. It is therefore by examining these points that we can attempt to interpret the results found on TFP trends. The interpretation must also take into account the fact that the factors of TFP development at the aggregate level of the economy are more complex than those determining changes at the level of a single company. On an individual scale, the increase in TFP reflects technological progress, while at the aggregate level, TFP can increase as a result of reallocations in resources to the most productive firms or sectors with higher productivity[5]. It is therefore by taking into account these various factors that the empirical results obtained must be assessed.

A considerable similarity between the Polynesian situation and that of neighbouring small island economies, first of all, suggests that some hindrances to productivity directly stem from the geographical and economic conditions of these isolated territories. However, the existence of periods of positive TFP figures suggests that conditions more conducive to an increase in productivity may emerge. The question then remains as to the persistence of phases of low or even negative values, which implies the possible existence of structural problems that go beyond geographical constraints alone.

Obstacles to productivity in small island economies

Like the neighbouring islands of the Pacific and other small territories located far from the world's large market zones, French Polynesia suffers from a foreseeable low-productivity factor syndrome.

Growth accounting studies carried out on several of these small economies (Bhaskara Rao *et al.*, 2007) show (Table 7) that growth is largely linked to the accumulation of production factors and virtually not to changes in TFP, even though the contribution of TFP is rarely measured as being significantly and sustainably negative (see also Faal, 2006).

As emphasised by a World Bank study (World Bank 2009) on world geography and development, the Pacific Islands are hurt concurrently by their small size, geographical isolation, limited access to global markets, fragmentation and enclosure by the sea. Looking at the three criteria "density", "distance" and "division", French Polynesia and the small neighbouring islands of the Pacific rank amongst the world's least favoured, when these three criteria are causes of production difficulties.

In French Polynesia, while most economic activity occurs on the island of Tahiti, the two flagship industries – tourism and pearl culturing – are largely developed in small islands far from Tahiti. Even on the main island, economic density is low, with the base of the activities scattered along a very crowded belt road. The distance to large global markets is on average one of the highest in the world (11,000 km versus an average of 8,100 km for the Caribbean islands, for example). Lastly, the internal geographical divisions are huge due to the fragmentation of islands and archipelagos (several hundred islands on an area equivalent to that of the European continent).

5. This is not automatic and it may happen that reallocations between companies are detrimental to productivity: see Bellone (2017), who refers to the "risk of 'impoverishing' job reallocations".

Table 7
Average annual growth rate (%) of TFP in a few Pacific island countries over the period 1972-2003

Fiji	Solomon Islands	Papua New Guinea	Samoa
0.1	- 0.1	0	0

Source: Bhaskara Rao *et al.* (2007)

These problems of insularity, small size and isolation have significant negative effects on economic efficiency and factor productivity (see in particular Winters & Martins, 2004). These small economies could produce in certain services sectors, in sectors protected from international competition and in those where it is still possible to export at prices that are sufficiently high compared to international competitive levels, for example in certain niche areas of tourism. However, the risk is then that they are limited to sectors of activity characterised by low and stagnant productivity (see Baumol, 1967, as well as all the research that has been carried out since on productivity gains in services).

Despite this challenging geographic and economic environment, phases of positive TFP contribution to growth have been observed over the long-term period under review. A few angles for interpreting these positive periods and the more frequent case of stagnant or even negative results are suggested here.

Factors influencing TFP in French Polynesia

The performance of French Polynesia in terms of TFP reveals periods of positive contribution, averaging at 2.4% per year between 1960 and 1973 or 1.8% per year from 1974 to 1987, then 1.6% per year over 1997-2000. As we saw above, the first period (1960-1987) reflects the high growth rates brought about by the activity of the Pacific Testing Centre. The second period encompasses the initial post-CEP year, a phase of significant expansion of own productive resources for the island, particularly in the tourism, fishing and pearl culturing sectors. The third period is relatively short (4 years) and can be defined as an expansion phase, in part driven by external factors. There is probably, in the increase in TFP during these years, a cyclical dimension, but it is also a period during which major structural changes in the economy took place: the reduction in customs duties and implementation of VAT, the development of large retail stores, and the concentration of the population on the main island (Tahiti). A hypothesis can be put forward as to the positive effects of these structural changes.

The most general results observed around the world regarding factors influencing productivity can be used to put forward some assumptions about the interpretation of TFP in French Polynesia. Obviously, only sufficiently long-term and reliable statistical data at a disaggregated level (individual companies or sectors) would make it possible to confirm or infirm these.

The entrepreneurial dynamic regained during years 1997-2000, though far from that of the CEP period, in itself facilitated the adoption of new technologies or organisational methods, as in the retail distribution sector (in particular via the reallocation of resources from small stores to large retailers[6]) or in the tourist accomodation sector. In addition, three major structural changes, likely to positively influence TFP, occurred during this period: a reduction in protectionism (through the gradual replacement of customs duties with VAT, hence lower rates and, above all, effects generating less distortion on relative prices[7]) with widely-known positive effects on TFP (Grossman & Helpman, 1991a; 1991); growth in public investments in transport and energy infrastructures, known to create an environment conducive to the growth of TFP (Bom & Ligthart, 2014); and densification in the urban zone on the island of Tahiti, a source of productivity gains via scale and agglomeration effects (Glaeser, 2011).

However, over the entire period studied and, more generally speaking, structurally, the Polynesian economy is characterised by a set of economic and institutional conditions generally not favourable to total factor productivity. While the economic literature recognizes that international openness, both for commercial flows and foreign direct investment, the quality of infrastructures, the level of human capital and the quality of the institutions, are factors for an increase in TFP, particularly where the last three are concerned, via the increase in the absorption capacity of the new technologies they generate, French Polynesia has well-documented shortcomings in all these areas.

The Polynesian economy remains highly protectionist, with a tariff protection rate (excluding VAT) of 15.6% on the value of total imports (Poirine & Gay, 2015, p. 134). Foreign investments are subject to government authorisation and are thus too often rejected (as in the case of the Digicel telephone operator in 2012, see Montet

6. For analysis of this point based on experience in the United States, see Foster et al.*, 2006.*
7. The tax burden as a percentage of total imports fell from 42% in 1996 to 23% in 2002 (Poirne & Gay, 2015, p. 153).

& Venayre, 2013). The narrowness of the markets and the isolation in general strengthen the presence of monopolistic or near-monopolistic structures (universal postal service, inter-island air transport operations, port and airport infrastructure management operations, electricity transmission, manufacturing of industrial gases, beer production or asphalt manufacturing) or oligopolies (telecommunications, production of cured meats, wholesale tobacco and drugs manufacturing, lighterage) on most markets (as the merger observation reports from the Polynesian Competition Authority emphasise, 2017). Lastly, the autonomy of French Polynesia has generated an institutional system that gives the local government enormous power when it comes to business, with clearly identified distorting effects[8] on long-term growth conditions (see Poirine, 2011; Venayre, 2011, 2012, 2013).

These elements converge to create structural conditions not conducive to growth in TFP, notably through the risks of poor intra and cross-sector allocations which they generate (see Caselli, 2005; Hsieh & Klenow, 2009, 2010; Klenow & Rodriguez-Clare, 2005; Peters, 2013; or Restuccia & Rogerson, 2008).

In the absence of data on TFP at the level of companies and sectors, it is obviously difficult to explore in greater depth the suggested research avenues in this latter section, in addition to comments on TFP trends (at the macroeconomic level) observed over long-term periods in French Polynesia. It would therefore be premature to derive economic policy recommendations from the data at this stage.

* *
*

Based on series of reconstructed data, an analysis of French Polynesia's growth accounting was conducted over the long-term period from 1960 to 2006. It shows that the contribution of TFP to growth was positive and relatively high during the CEP period (from the early 1960s to the end of the 1980s) and for a short period in 1997-2000. In contrast, it was negative in years 1988-1997 and after 2001. Despite negative "natural" factors, such as remoteness and the small size of the economy, low TFP is by no means inevitable in level or as a negative trend in a small, isolated economy like that of French Polynesia.

The general knowledge accumulated on factors likely to play a positive role in the trend in TFP and its contribution to growth on the one hand and the analysis of growth and economic policies implemented in French Polynesia on the other, call for further research on policies aimed at strengthening international openness, fostering competition and developing network infrastructure investments. □

8. The government steps in to grant licenses in a large number of markets (telecommunications, energy, transport), but also to protect companies in place through customs duties, subsidies, etc. The result is a strong incentive for dominant companies to develop close ties with governments, facilitated by the small size of the territory, and incentives for political decision-makers to protect the firms in place.

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APPENDIX 1

ANALYSIS OF THE ROBUSTNESS OF THE TFP ESTIMATION HYPOTHESES REGARDING COEFFICIENTS *α* AND *r*

The estimated TFP is based on equation (3), setting the values of coefficient *α* (share of capital) at 30% and coefficient *r* (marginal effect on real GDP growth rate of an additional year of study E) at 7% based on the estimates of Bergeaud *et al.* (2018; 2016). In order to study its robustness, we estimate the growth rate of this estimator for two values commonly used in parameter *α* (30% and 40%), and two values of parameter *r* (6% and 12%), which match the endpoints in the range of values estimated in the literature (Barro & Lee, 2013), both for French Polynesia and France (including overseas departments).

Gaps in TFP growth rate stemming from the rise in the parameter *α*, from 30% to 40% are similar between the two economies (-0.4 percentage point for French Polynesia and -0.3 percentage points for France), regardless of the value of the parameter *r* over the period 1960-2006. These differences come mainly from the period 1960-1987, characterised by strong growth and high volatility.

The growth differential in TFP between France and French Polynesia, linked to the increase in parameter *α* from 30% of 40%, is less than 0.1 percentage point per year (table A1).

Gaps in the TFP growth rate due to the increase in parameter *r* from 6% to 12% are higher for French Polynesia (-0.5 percentage point) than for France (-0.1 percentage point), regardless of the value of parameter *α* over the total period 1960-2006. These differences are particularly significant for the period 1960-1987 for both economies, but also for the period 2001-2006 for French Polynesia. Nevertheless, the gaps in TFP growth differential between France and French Polynesia, stemming from the increase in parameter *r* from 6% to 12%, are slightly less than 0.4 percentage points per year.

Following this analysis, and even if the setting of the parameters *α* and *r* could be refined through empirical studies on French Polynesia, we consider our TFP estimate to be robust.

Table A1
Estimated PGF* for French Polynesia and France according to different values of *α* and *r*

α (%)	*r* (%)	Annual growth rate (in logarithmic difference)					
		1960-73	1974-87	1988-96	1997-2000	2001-06	1960-2006
French Polynesia							
30	7	2.4	1.8	- 0.3	1.6	- 1.2	1.1
30	6	2.5	1.9	- 0.3	1.6	- 1.1	1.2
40	6	1.5	1.5	- 0.2	1.8	- 1.0	0.8
30	12	2.0	1.4	- 0.4	1.9	- 1.9	0.7
40	12	0.9	1.0	- 0.4	2.2	- 1.9	0.3
France							
30	7	2.9	0.7	0.4	2.1	0.2	1.5
30	6	3.0	0.8	0.4	2.2	0.2	1.5
40	6	2.5	0.4	0.3	2.0	0.1	1.2
30	12	2.9	0.6	0.3	2.0	0.2	1.4
40	12	2.4	0.3	0.3	1.9	0.0	1.1
Growth differential between France and French Polynesia (in percentage points)							
30	7	0.52	- 1.07	0.67	0.49	1.42	0.42
30	6	0.44	- 1.14	0.65	0.57	1.29	0.36
40	6	1.04	- 1.07	0.56	0.20	1.12	0.45
30	12	0.88	- 0.76	0.77	0.10	2.07	0.74
40	12	1.48	- 0.68	0.69	- 0.28	1.90	0.82

Note: * TFP estimated from equation (4) Log(TFP) = Log(*y*) – *α* Log(*k*) – *rE* (see box 4).
Scope: French Polynesia and France (mainland France and overseas departments, excluding Mayotte), economy as a whole.
Sources: For French Polynesia: database built by the authors based on Insee's economic accounts (1960-1976), ITSTAT (1976-1996), ISPF (1987-2014), and CEROM (2015-2016), base 2005; authors' estimates. For France: Insee, National accounts, 2016 provisional (2010 base); authors' estimations.

APPENDIX 2

ANALYSIS OF THE ROBUSTNESS OF THE TFP ESTIMATION HYPOTHESES REGARDING CALCULATION OF LEVEL OF EDUCATION *E*

Estimating TFP based on equation (4) as a factor of educational achievement consists, according to the methodology of Barro and Lee (2013), of constructing the average number of years of schooling *E* for the population ages 15 and over, as the average duration of time spent in school to earn a degree, weighted by the percentages of the population having earned these degrees. The classification of diplomas is the same as that used in the International Standard Classification of Education (UNESCO) (2011):

- ISCED Level 0 has no time criterion, a curriculum must amount to at least 2 hours per day and 100 days per year of educational activity to be included;
- ISCED Level 1 has a duration varying from 4 to 7 years, with a median duration of 6 years;
- ISCED Level 2 has a duration of 2 to 5 years, with a median duration of 3 years;
- ISCED Level 1+2 reflects total cumulative duration of 9 years, i.e., the time required to earn a French CEP or a BEPC;
- ISCED Level 3 amounts to 2 to 5 years, with a median duration of 3 years;
- ISCED Level 1+2+3 amounts to total cumulative duration of 12 years, i.e., the time required to earn a French Baccalaureate;
- ISCED Level 4 lasts anywhere from 6 months to 2 or 3 years;
- ISCED Level 5 lasts anywhere from 2 to 3 years;
- ISCED Level 6, which occurs after level 3, varies from 3 to 4 years, and has a total cumulative duration of 15 years, i.e., that required to earn a first-cycle degree ("*licence*", the French Bachelor's degree);
- ISCED Level 7 follows Level 6, varies from 1 to 4 years, and has a total cumulative duration of 17 years, i.e., that required to earn a second cycle degree (Master's degree).

Using data on the State of Higher Education and Research for France and ISPF for French Polynesia, according to the same methodology and the same definition as Barro and Lee, we estimate the respective average lengths of time spent in school during the period 2004-2006, weighting the proportions of the population ages 15 and over, which earned the highest degrees as listed below:

- no degree, with a maximum duration of 5 years (ISCED 0);
- a CEP or BEPC, with cumulative duration of 9 years (ISCED 1+2);
- a CAP or BEP, with cumulative duration of 11 years;
- a Baccalaureate, with cumulative duration of 12 years (ISCED 1+2+3);
- a first-cycle degree, with cumulative duration of 15 years (ISCED 1+2+3+6);
- a second-cycle degree, with cumulative duration of 17 years (ISCED 1+2+3+6+7).

This provides us with the respective values of 12.3 years for France and 9.0 for French Polynesia, i.e. a difference of 3.3 years in 2005 (average for the period 2004-2006). We then calibrate our estimator for French Polynesia to adjust the value estimated above for France to that estimated by Barro and Lee.

In order to study the robustness of the TFP to this calibration, we then estimate the growth rate of this estimator for different values of this difference in the level of education between France and French Polynesia in 2005.

The difference in the TFP growth rate due to the variation in this parameter is relatively low for the different sub-periods, except for the last years 2001-2006, and almost zero over the whole period 1960-2006 (table A2). The estimated TFP estimation appears robust to the calibration.

Table A2
Estimated TFP* for French Polynesia for different values of the gap in the level of *E* (educational attainment) between France and French Polynesia

Difference in *E* (in years) between France and French Polynesia in 2005	1960-73	1974-87	1988-96	1997-2000	2001-06	1960-2006
	Annual TFP growth rate (in logarithmic difference)					
3.3	2.4	1.8	- 0.3	1.6	- 1.2	1.1
2.8	2.3	1.8	- 0.2	1.5	- 1.0	1.1
2.1	2.2	1.7	- 0.2	1.4	- 0.7	1.1
	TFP growth differential between France and French Polynesia (percentage points)					
3.3	0.52	- 1.07	0.67	0.49	1.42	0.42
2.8	0.62	- 1.04	0.62	0.59	1.22	0.42
2.1	0.78	- 0.98	0.56	0.73	0.92	0.42

Note: * TFP estimated from equation (4) $\text{Log}(TFP) = \text{Log}(y) - \alpha\,\text{Log}(k) - rE$, with $\alpha = 0.3$ and $r = 0.07$ (see box 4).
Scope: French Polynesia and France (mainland France and overseas departments, excluding Mayotte), economy as a whole.
Sources: For French Polynesia: database built by the authors based on Insee's economic accounts (1960-1976), ITSTAT (1976-1996), ISPF (1987-2014), and CEROM (2015-2016), base 2005; authors' estimates. For France: Insee, National accounts, 2016 provisional (2010 base); authors' estimations.