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The Leviathan Untamed: A Cost-Benefit Interpretation of 200 Years of Government Growth in the G7 Countries

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Abstract

A surprising *first stylized fact* about developed capitalist economies is that the growth of government expenditure (G) has, in the long run, been several times faster than the growth of GDP (Y). As a result, countries where the G/Y ratio was in the single digits in the nineteenth century, are now converging to around 45%. Moreover, the dynamic pattern is similar across countries: an S-shaped trajectory, similar to a logistic curve. This is a *second stylized fact*. The composition of expenditure suggests that the main drivers tend to be similar across countries over time, pointing to the demand and supply of a range of services. This is a *third stylized fact*.

The paper, after a taking stock of Wagner's Law and Pigou's Excess Burden of Taxation, combines them in a dynamic equation of the growth of government. Then we propose an empirical analysis of G/Y dynamics for G7 countries, confirm that there is a common S-shaped trajectory, and offer an interpretation in terms of benefits and costs of government expenditures. Finally, we suggest some policy implications suggesting a conflict between the welfare state and a sustainable trajectory of public finance and the need for non-tax revenue leveraging on public assets.

Keywords: public expenditures, size of government, G7 countries

JEL codes: H10, H11, H50

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1 Introduction

In an opening salvo as appointed leaders of the DOGE (US Department of Government Efficiency), Elon Musk and Vivek Ramaswamy stated, inter alia:

> "Finally, we are focused on delivering cost savings for taxpayers. [...] DOGE will help end federal overspending by taking aim at the $500 billion plus in annual federal expenditures that are unauthorized by Congress or being used in ways that Congress never intended [...]"

Later there was greater ambition, targeting 1-2 trillion USD cuts[1]:

> "If we try for $2 trillion, we've got a good shot at getting one [...] And if we can drop the budget deficit from $2 trillion to $1 trillion and kind of free up the economy to have additional growth — such that the output of goods and services keeps pace with the increase in the money supply — then there will be no inflation. So that, I think, would be an epic outcome.[2]"

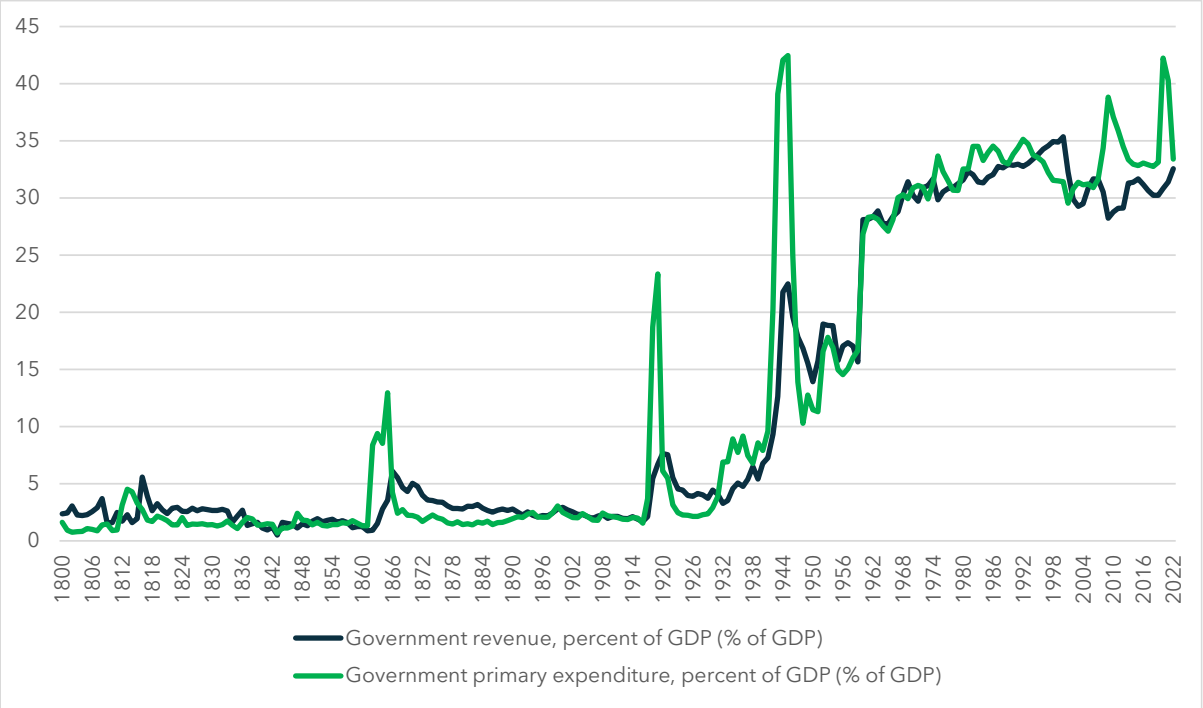
To put this figure in perspective, the federal government expenditures of the US were about 6.9 trillion USD in 2023[3]. These expenditures include publicly provided Health Insurance, Social Security, Defense, Net Interest on public debt, Veterans and federal retirees, Economic Security, Education, and other programs. To these federal expenditures one has to add State level spending, ending up with US general government expenditures of over 36% of GDP (after reaching 45% in 2020, the Covid-19 pandemic year)[4].

Compared to the US government expenditures for most of XIX Century and early XX Century before the 1920s, this represents a 1800 % increase, or in other words, government spending grew 18 times faster than GDP. Why? And how realistic and beneficial would it be to go back in time to the size of government of the 1950s, about 20% of GDP?

To answer these questions, we need to examine the dynamics, determinants and consequences of the long run growth of public spending. Figure 1 shows US government expenditure and tax revenues as a percent of GDP (G/Y) from 1800 to 2022.

[1] https://www.bbc.com/news/articles/cdj38mekdkgo
[2] https://x.com/Live/status/1877200335443304685?mx=2
[3] https://www.cbpp.org/research/federal-budget/where-do-our-federal-tax-dollars-gowith
[4] https://www.imf.org/external/datamapper/exp@FPP/USA/FRA/JPN/GBR/SWE/ESP/ITA/ZAF/IND

Figure 1: Government revenues and primary expenditure, US 1800-2022



Several theories have been proposed to interpret the growth of government over time. Most of them are rejected by close inspection of the available long run data. Wagner's (1890) Law, which states that a shift in citizens' demand for higher quality goods is correlated with higher income, may have been approximately true in the past. However it would imply a sustained exponential process. This is not what we observe. Wagner's Law, in fact, implies an elasticity of demand to income in excess of unity for goods and services provided by government. This is approximately true for the first part of the S-shaped curve that we observe. Political economy views related to democracy, the median voter theorem, and the dominance of redistributive policy required by the poor are also rejected. There are profound differences across G7 countries in terms of history of their institutions. Countries as Japan, Italy, Germany, France have experienced war-time authoritarian regimes, while others, such as the US, UK, Canada have a history of continued democratic institutions. They show broadly similar patterns, though.

Other theories related to hysteresis after wars or other exogenous shocks, which appear as structural breaks in the time series, may have some short-term validity, but in the long term are also rejected, because usually the trend is not actually changed by specific events.

We propose a simple theory (based on Florio and Colautti, 2005) that combines Wagner's Law (on the utility side) with the welfare cost of taxation (going back to Pigou's 1947, discussed in Atkinson and Stern 1974). The theory would combine a Wagnerian-type driver of government expenditures on the benefit size with a Pigouvian-type brake on the cost size. The resulting dynamic model takes the form of a non-linear differential equation, generating a S trajectory over time, similar to the Verhulst logistic. Using a simple econometric model in such framework, we identify a common dynamic pattern for G7 countries.

We are then able to identify rate of growth of G/Y, flex point, and convergence to a steady state of G/Y (median value for the G7 45%).

We then move to our research question about the impact of such dynamics on aggregate social welfare. At this stage we discuss this issue qualitatively, but propose an analytical framework for further research.

A number of authors have suggested that this evolution is inefficient and hampers GDP growth, mainly on the basis of empirical arguments. We qualitatively discuss these arguments and suggest, as a next step, how to integrate our empirical model in a wider framework. Since GDP itself is an increasingly inadequate measure of socio-economic progress, one would need to show that the growth of government has been detrimental to social welfare in the long run, or otherwise. In other words, we would need to extend a benefit-cost framework to interpret the stylized facts and their consequences: long run growth of public expenditures, shape of the trajectory, determinants and welfare effects. We discuss possible ways of building such a framework.

Finally, we discuss some policy implications of our findings and interpretations. In a nutshell, we conclude that after a long history of growth of government, driven by benefits that were perceived and probably actually were considerably higher than the burden of taxation, the process is now slowed by the latter effect, a social cost. However, going back to old times is unrealistic, because it would just trigger the same mechanisms that created a demand for publicly provided or supported health services, social security, public investment including in human capital, i.e. the modern welfare state, compounded with new investment in science and climate change adaption, beyond those government functions already envisaged by Adam Smith: infrastructure, law and order, defence.

This is not the end of the story. We suspect that the convergence to about 45% G/Y will not be sustainable in the rest of the XXI Century, because there are contingent liabilities related to entitlements, pressures on pension and health spending arising from ageing and declining total factor productivity, to interest on past debt and other drivers, that would further create tensions. Governments would face a conundrum between cutting popular programs or raising taxes and public debt. From Thatcher to Trump conservative governments have tried and failed to find downsized government equilibrium, and paradoxically ended up to raise G/Y, debt, or both. Evidence of this unsustainable path is the dramatic decline in the last decades of the net worth of the public sector in the G7 countries, and notably in the US (Ball et al 2024). A question for further research is to what extent increasing government revenues without increasing taxation is possible. A possibility to be explored is recurring to wider and more efficient development of state-owned tangible and assets and enterprises.

2 Conceptual Framework

Recalling Florio and Colautti (2005), from which here we heavily draw, Wagner's Law implies that G/Y grows over time because government offers superior goods, not supplied by the private sector, see Henrekson (1990, 1993), Fölster S., Henrekson (2001) for different testable models. If η is the elasticity of G/Y to per capita income, one possible interpretation of the Law is simply: G/Y = f(Y/N) and η>0, where N is population. To simplify, let assume that the economy grows endogenously without changes in labour force: Y = Y(t); N = N(t); G = G(t) and dY/dt >0, dN/dt =0, where t is time.

We use the following notation:

$$g = \frac{d \log G}{dt} = \frac{1}{G}\frac{dG}{dt} \qquad [1]$$

$$y = \frac{d \log Y}{dt} = \frac{1}{Y}\frac{dY}{dt} \qquad [2]$$

It easy to see that defining $R = G/Y$, $dR/dt = hR$, where: h = g-y and $h(G/Y) = 1/Y(dG/dt) - G/Y\,[1/Y(dY/dt)]$. This is equivalent to the derivative of G/Y:

$$dR/dt = [Y(dG/dt) - G(dY/dt)]/Y^2 \qquad [3]$$

Obviously h > 0 implies dR/dt >0, R0>0 (government exists since the beginning of the process). It is worth to observe that h = y (η -1). If y >0 and constant by assumption and η > 1 and constant as well, grows exponentially : $R = R_0 e^{ht}$. However G/Y > 1 would require to tax income several times, or to recur to debt or seignorage without any constraints. To see why there are constraints, and again to simplify, let us assume that G=T, and public debt and seignorage are impossible, hence R = T/Y. If the production of the public good G is under constant returns, leisure is untaxed, there is no lump sum tax, but only an indirect tax, an excess burden of taxation E arises. It easy to see that E must be (at least) quadratic in T/Y. To simplify and set aside distributive issues, the economy has one consumer, one private good and one publicly provided good. Demand and supply after tax balance. Quantity of the private good is x, production cost is p. Hence: T=θpx were θ is the effective tax rate and $\theta = T/px$. The public good is given for free, hence taxable income is Y=px. At t=0 there is no tax, θ=0. Then dp=θp= τ, where τ = T/x is the tax for a small unit of good. The Marshallian (or with some manipulation, the Hicksian) demand price elasticity of the private good is ε = |(dx/dp)/(x/p)| and by substitution dx = εxθ. Hence a very simple definition of E is:

$$E = dxdp/2 = Y\varepsilon\theta^2/2. \qquad [5]$$

Recalling that G=T and Y=px:

$$E/Y = \varepsilon\theta^2/2 = (\varepsilon/2)(T/px)^2 = (\varepsilon/2)(G/Y)^2. \qquad [6]$$

E/Y is our Pigouvian constraint to the Wagner Law. For a benevolent government d(G/Y)/dt = 0 when (FOC of welfare maximization) the benefit of G/Y = the cost of E/Y, where the sign for E/Y coefficient is negative (because it is a social cost).

One way to write this benefit-cost rule in the form of a Wagner-Pigou Law is:

$$d(G/Y)/dt = \alpha y(\eta - 1)(G/Y) - \beta(\varepsilon/2)(G/Y)^2 \qquad [7]$$

where α, β are parameters that may reflect institutional factors, such as the actual influence of tax-payers on government decisions. [7] is a non-linear first-order ordinary differential equation that can be written alternatively be written as follows:

$$d(G/Y)/dt = (G/Y)(h - k(G/Y)) \quad [8]$$

where $h = \alpha y(\eta - 1)$ and $k = \beta\varepsilon$.

In the form [7] the equation is the logistic function , firstly introduced by Verhulst (1838) to study Malthusian population growth. The logistic function , see Fig. X, has the following useful features in our context: dR/dt >0 only if /K= h/k/ >R; with h>0, k>0 ceteris paribus, their ratio is then the upper limit of R: hence dR/dt=0 , G and Y must grow at the same speed . However, near t=0 and R=0, dR/dt = hR, looks similar to Wagner's exponential growth.

The integral value of the function is

$$R_t = K/\left(1 + Ce^{-ht}\right) \quad [9]$$

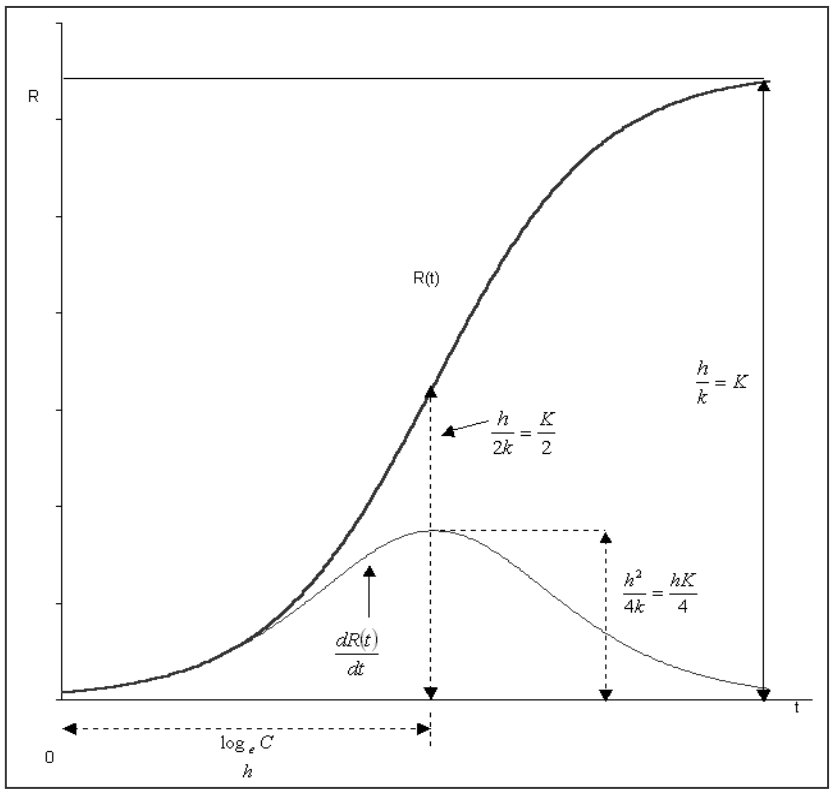
while the proportional derivative is a simple linear function:

$$d\log R/dt = 1/R\left(h - kR\right)R = h - kR \quad [10]$$

A unique flex point occurs at point $t = (1/h)\log C$ and there the G/Y ratio is at half of its maximum value: i.e. K/2. At that point dR/dt reaches its maximum value or hK/4.

The logistic is one of several possible S-shaped curves that result from the combination of an impulse to grow and a constraint, but for the empirical application it is convenient to take advantage of its properties. Further research may explore more general models, see Appendix.

Figure 2: Logistic curve



3 Empirical Model

An empirical model consistent with the above mentioned simple theory should be able to fit the data to a logistic growth. One of such models is the following 4 Parameters Logistic:

$$y_t = a + \frac{b}{1 + c \times \exp(-dt)} + u_t \;\; u_t \sim iid(0, \sigma^2)$$

Where:

a = lower bound (0<a<100)
b = upper bound (0<b<100)
c = scale parameter (c>0)
d = growth parameter (d>0)
t_{flex} = ln(c)/d inflection point

In this model, when the second derivative changes sign, (i.e. maximum growth rate), we have the estimated flexpoint.

Alternatively, we can get the initial value as zero , and in such case we have the 3 Parameters Logistic

$$y_t = \frac{b}{1 + c \times \exp(-dt)} + u_t \;\; u_t \sim iid(0, \sigma^2)$$

The interpretation is the same as above when a=0.

In this context for estimation we might use non-linear least squares (NLLS), with Newey-West Heteroskedasticity- and autocorrelation-consistent (HAC) Standard errors.

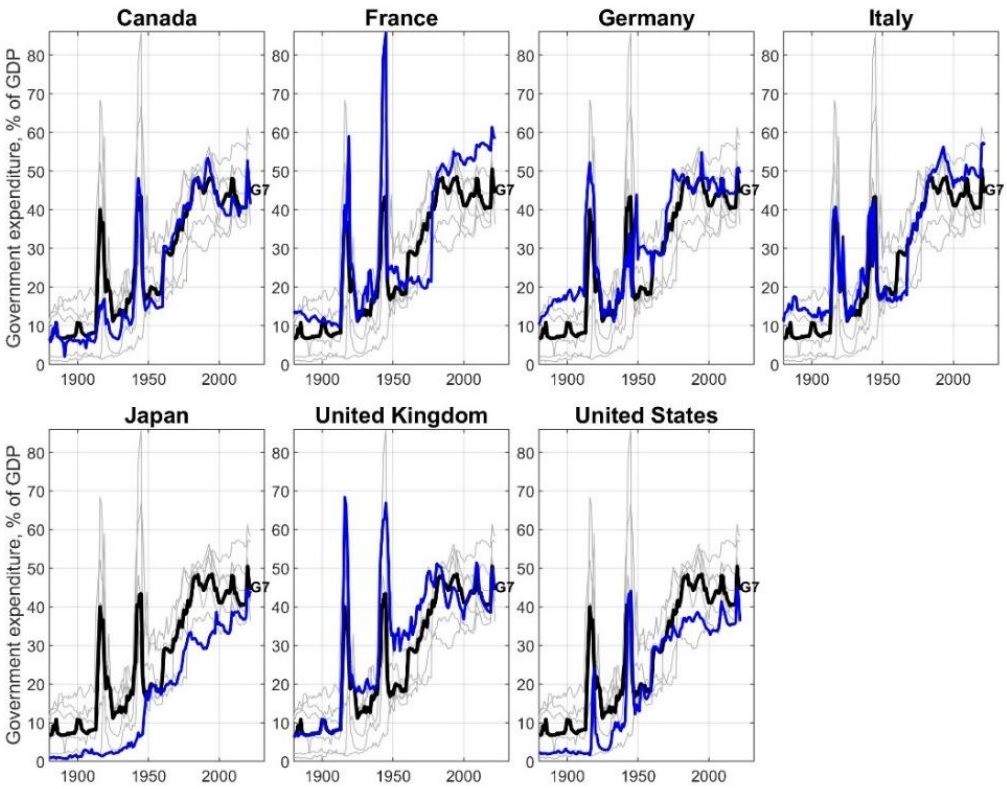
It is known that NLLS estimates are sensitive to initial values, ϑ_0, used by the estimation algorithm, hence we proceed as follows:

- Fit the 3 parameters model with $b_0 = \max(y_t)$, $c_0 = 1$, $d_0 = 1$ and save the estimates in $\hat{\theta}_{Log3}$
- Fit the 4 parameters model with initial parameters $a_0 = \min(y_t)$, and $\hat{\theta}_{Log3}$
- In both cases we enforce upper and lower bounds in the estimation algorithm to have estimates in the desired ranges
- Standard errors for t_{flex} = ln(c)/d are based on the Delta-method.

4 Data and Findings

We first show our raw data from IMF[5] in the form of trends by country, both without and with HP filtering them, and the median trend as well. Missing data have been interpolated (See Statistical Annex)

Figure 3: Raw data and trends(G7 = median value missing filled using median growth rate of other countries)



[5] https://www.imf.org/external/datamapper/datasets/FPP

Figure 4: Raw country data

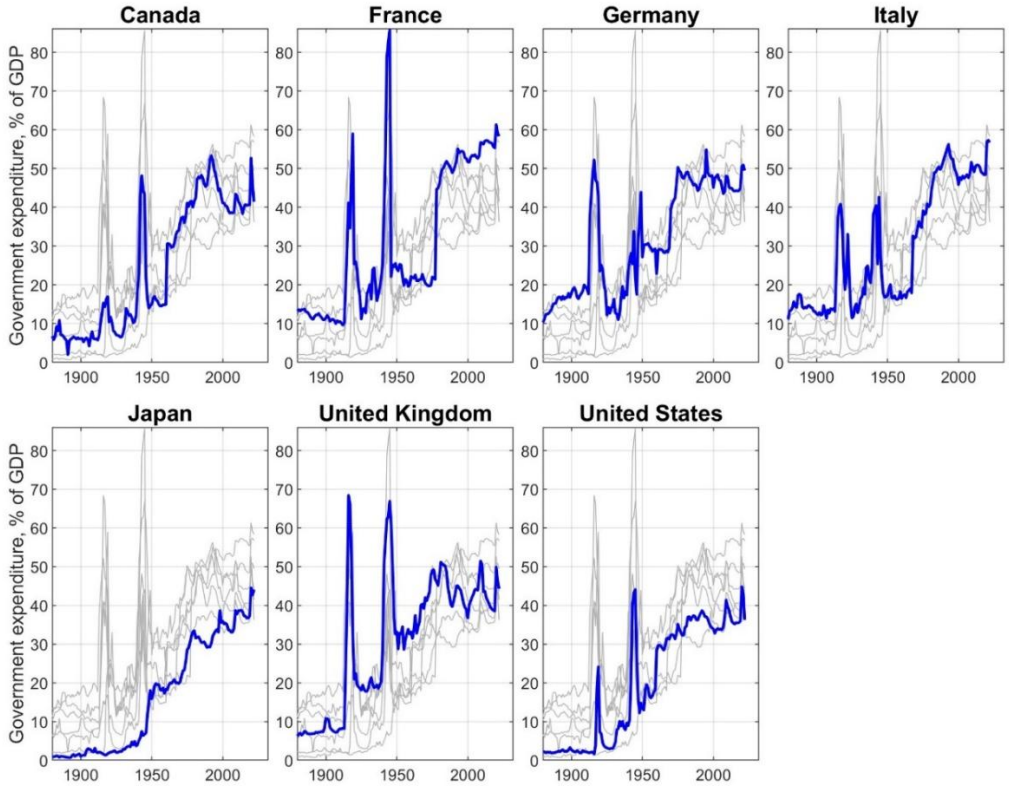


Figure 5: HP smoothed trends (parameter =100) by country compared with the median

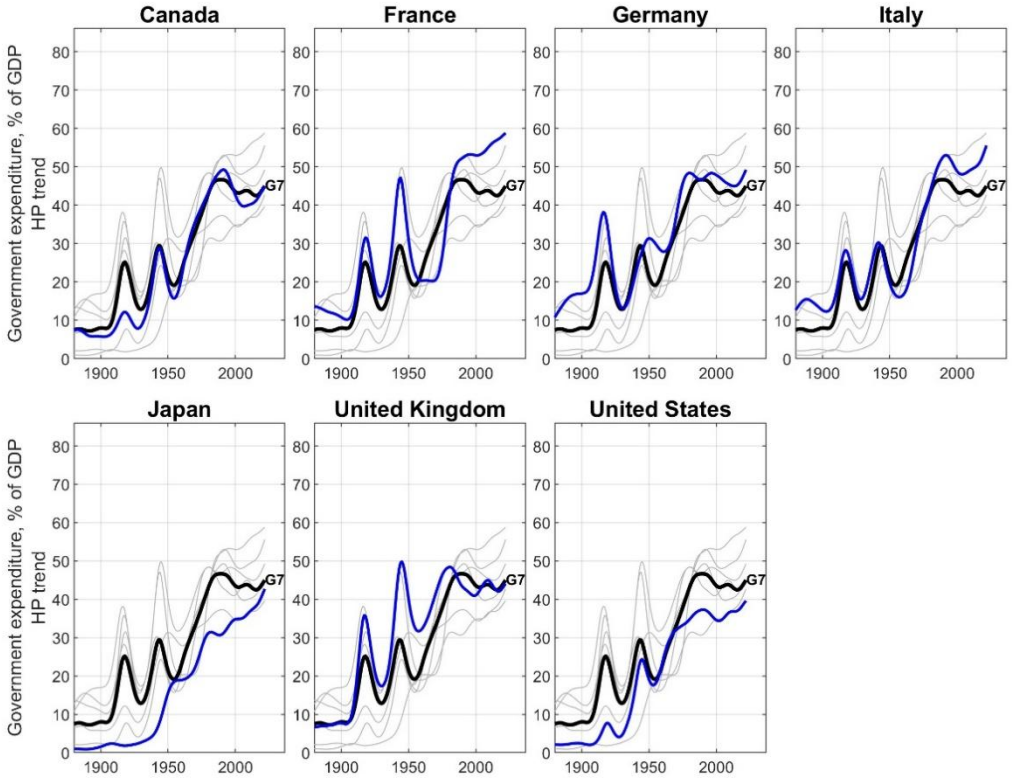


Figure 6: As above, by country

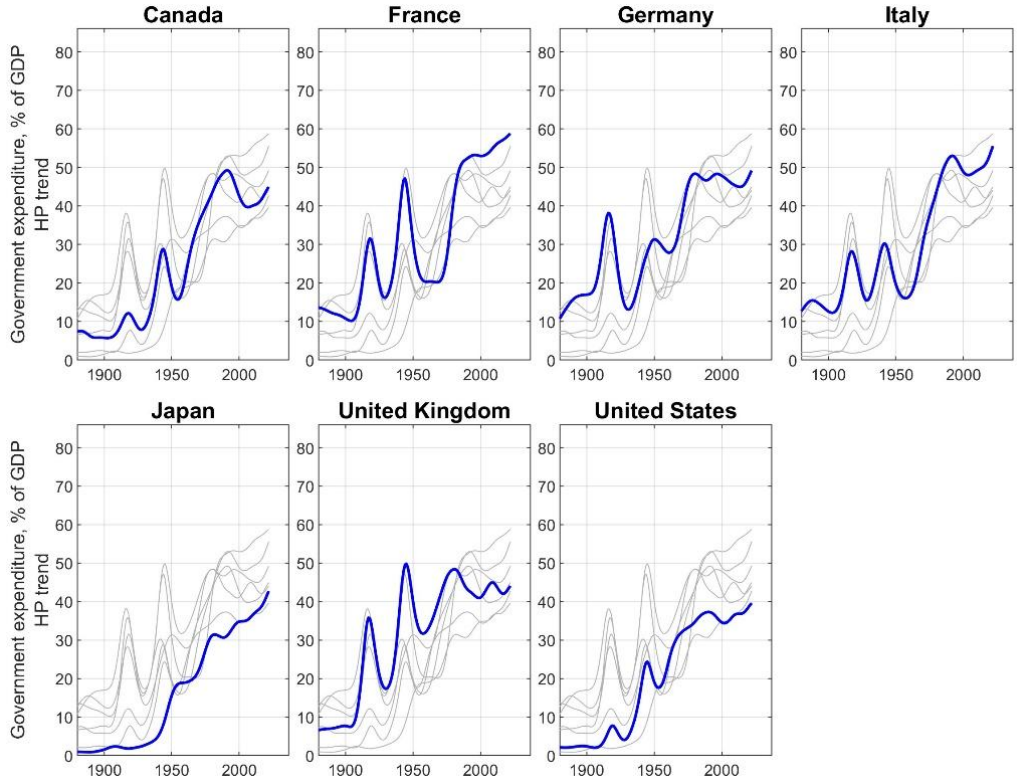
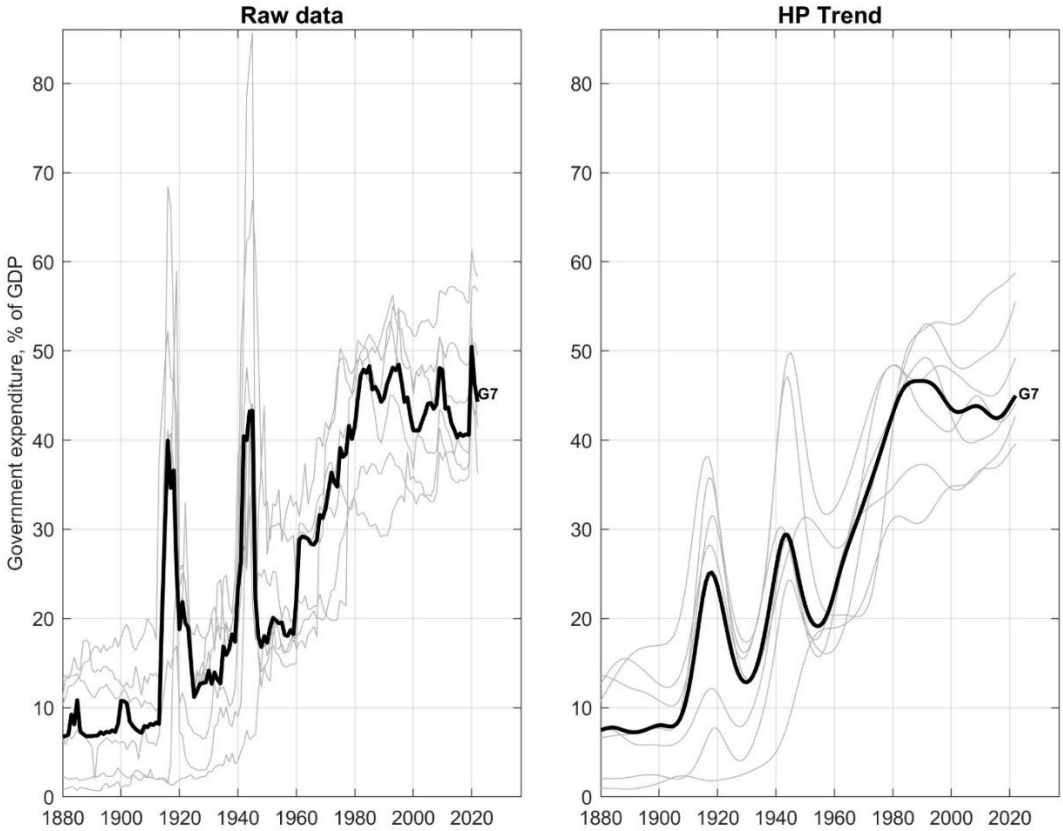


Figure 7: G/ Median, raw and HP filtered



Visual inspection of the trend in the above figures reveals some simple but interesting facts:

- For the G7 countries, which in 2023 represented around 30% of global GDP, and are considered the core of contemporary developed market economies, the filtered G/Y available data since 1880 suggest rapid growth, similar to an exponential process (upper concavity to time) for about one century, until a clear break around 1980, and a flattening of the trend in the last about 40 years
- A S-shaped trajectory is more visible when Japan (a country with the highest public debt, 263% of GDP) in the group is not considered. Japan clearly shifted to public debt the Pigouvian cost, recurring increasingly to it instead of taxation. The roughly S-shaped pattern is particularly apparent in Canada, UK, Germany, where the 'brake' seems to be more constraining in recent years, while in the US, France and Italy a steady state seems not yet reached.
- In terms of initial levels, Japan and the US started with a lower G/Y, while the remaining countries started slightly higher (France, Germany, Italy) or lower (Canada, UK, with the US particularly lower) than 10%.
- Given the differences in initial levels (while only for some countries further distant historical data are available) a common trend would result in quite different growth rates of G/Y and steady state.

Table 1. shows the results of the 4-parameters model, and Table 2 of the 3-parameters. These are preliminary results that should be interpreted more qualitatively than as precise quantitative estimates.

Table 1: Logistic estimate, G7 1880-2023 (4 par. Model)

	Canada	France	Germany	Italy	Japan	United Kingdom	United States	G7
lower bound, a	1,05	8,13	8,87	6,53	0,00	2,70	0,12	3,17
s.e.	2,16	0,87	3,08	0,86	0,99	1,18	0,75	1,14
upper bound, b	41,39	50,13	39,37	44,50	34,85	42,38	40,33	39,34
s.e.	4,09	2,91	5,25	2,88	2,21	3,32	4,14	1,98
c	47,26	177,16	21,42	134,44	96,82	254,60	625,29	54,87
s.e.	44,79	148,48	22,49	85,38	95,61	311,20	871,94	29,40
d	7,51	8,61	6,82	7,84	9,09	9,33	9,23	8,69
s.e.	1,82	1,54	2,19	1,13	1,82	2,13	2,21	1,10
t_{flex}	1961	1976	1959	1972	1962	1955	1963	1960
90% C.I	1958	1974	1955	1970	1960	1952	1959	1958
	1964	1979	1963	1975	1965	1958	1967	1962
t_{max}	2065	2066	2063	2079	2046	2065	2089	2046

Table 2: Logistic estimate, G7 1880-2023 (3 par. Model, a=0)

	Canada	France	Germany	Italy	Japan	United Kingdom	United States	G7
upper bound	48.169	90.000	70.019	90.000	38.809	43.993	37.916	53.685
s.e.	3.224	43.827	16.427	39.932	1.214	1.460	1.109	5.561
c	23.806	7.978	4.247	8.139	176.014	9.032	83.907	8.304
s.e.	7.599	3.851	1.191	3.291	71.098	4.493	45.149	1.983
d	6.359	2.692	2.454	2.566	8.915	7.926	9.254	4.183
s.e.	0.861	0.881	0.614	0.727	0.764	2.014	1.077	0.730
Flex Time	1951	1990	1964	1996	1962	1919	1948	1952
90% C.I	1945	1921	1918	1941	1961	1914	1945	1940
	1956	2022	2009	2022	1964	1925	1951	1963

In what follows we briefly comment on Tab 1, as results in Tab 2 are by comparison only if the lower bound is set at zero, which is obviously unrealistic even if for some estimation reasons may be attractive.

First of all, the model correctly estimates a convergence of the G7 *as a group* to G/Y= 0,45. The main outlier here is Italy, a country with high public debt, and France, a country that is quickly cumulating public debt. UK, Canada and Germany would converge to a steady state in the range of G/Y= 0.43-0.49. US and Japan, by contrast would converge to a range 0.36-0.38.

In terms of growth rate, however, the countries whose government has been historically growing more are Uk, Japan, Canada, with USA to top one. The latter has d= 0.103, which is close to be two times the G7 average (d=5.3).

The flex time of the logistic would be 1955 for the G7, but much earlier for the UK, and much later for Italy and France. The statistical reliability of estimation of the flexpoint for individual countries is however low, see the large standard errors.

Tab. 3 shows how the results would change if World War years are exclude from the sample.

For the G7 as a group the upper G/Y= 0.46 value is robust and it is confirmed that the growth of government over time was faster in Canada, UK, Japan and particularly in the US, d= 12.2 for the latter.

The flexpoint year is 1958 for this G7 sample, confirming that the wars may have acerated the process, but not dramatically so. It is confirmed that the turning point is more recent for France and Italy, more distant for the UK (1937), but for the other countries the range is 1954-1962.

Table 3: Without WWI and WWII years

des	Canada	France	Germany	Italy	Japan	United Kingdom	United States	G7
lower bound	4.652	6.412	7.461	7.292	0.000	3.962	1.780	4.276
s.e.	1.044	3.994	7.449	5.839	0.596	1.530	0.237	2.133
upper bound	41.787	84.048	48.286	65.186	39.196	41.266	35.785	45.996
s.e.	2.606	42.366	16.125	29.283	1.942	2.436	0.880	5.576
c	196.948	28.179	10.632	21.588	128.270	27.907	600.000	28.820
s.e.	185.479	17.724	13.314	23.202	82.958	16.381	287.340	21.708
d	9.534	4.026	4.452	4.179	8.390	8.239	12.258	6.094
s.e.	1.667	1.666	2.404	2.208	1.146	1.351	0.969	1.481
Flex Time	1959	1998	1955	1984	1962	1937	1954	1958
90% C.I	1956	1965	1947	1960	1960	1934	1953	1954
	1961	2022	1965	2009	1964	1939	1955	1963

This confirms qualitatively earlier results, with a smaller sample, shorter period of time, and different estimation method, by Florio and Colautti (2005, p 389). We show here for convenience their Tab 7, that does not include Canada and Japan. Their average upper bound G/Y was 51,3%, which exceeded our estimate by 5.7 points. Their average flex year is also ten years earlier (1945) than in our estimates with war years (1955). In both set of estimations, it is interesting to observe that, contrary to popular perceptions, the advent of the modern welfare state, mainly in the 1960s, did not increase the rate of growth of government, probably because of a pro-growth interaction with GDP itself. Florio and Colautti (2005) suggested that according to their estimates the XXI century would still be a time of long run increase of the size of government.

Would Elon Musk and the second Trump administration be able to reverse this trend in the USA and initiate a global downsizing of government by imitation of the other countries?

The answer to this question lies in understanding the determinants of the process and its impact: a task that goes beyond this paper, but that we discuss in the next section.

Table 4: Earlier estimates by Florio and Colautti (2005)

Country	Author	Parameter				Flex year	Max. $G/Y^{(1)}$	Max. Year$^{(2)}$
		R_0	K	C	h			
United States	Musgrave	4.20	38.71	19.00	0.05	1946	42.91	2101
France	Delorme	11.00	47.13	103.51	0.07	1941	58.13	2055
Italy	Brosio/Others	11.10	45.50	16.86	0.03	1955	56.60	2187
Germany	Flora	9.70	39.10	36.60	0.05	1942	48.80	2105
United Kingdom	Middleton	7.80	42.70	66.25	0.05	1941	50.50	2108

Note: (1) Upper limit of *G/Y*
(2) Defined as the year corresponding to a value of the dR(t)/dt<0.0001

Source: OECD

5 Public Expenditures by Function

To understand the long run drivers of G/Y one needs to look to its composition in the first place. In this perspective it is immaterial the accounting separation between public consumption and investment on one side, and transfers on the other side, as the latter are still the expression of a social demand for a service provided by the state. Unfortunately there are no homogeneous time series for the functional classification of public expenditures going back in XIX and most of XX Century, but the OECD provides some harmonised series by country for the last 30-50 years, up to more than 70 years for the US : "The classification system used to provide this breakdown on an internationally comparable basis is known as the Classification of Functions of Government (COFOG). COFOG is available at two levels: A first level which splits expenditures into ten functional classes, and a second level which further splits the first level classes into up to nine further classes"[6].

Let us go back to US government expenditures, the target of DOGE, compared with the EU aggregate of its Member States (the EU, to be reminded, is not a federation, but a Union of sovereign states, with the European Commission budget about just 1% of EU GDP). Thus the comparison is purely indicative.

Table 5: US vs EU: general government expenditures by functions as % of GDP (2023)

COFOG	US	EU-27
Economic Affairs	3.22	5.76
Health	10.08	7.25
Defense	3.03	1.31
Education	5.39	4.67
Social Protection	7.86	19.16
General public services	6.85	5.86
Environmental protection	0.00	0.82
Housing	0.46	1.15
Public order	1.84	1.69
Recreation and culture	0.24	1.16

Source: OECD[7]

Table 5 is for the most recent available year

Data on the functional classification of general government expenditures, provided by the OECD, spans the last 70 years for the US and 30 years for the EU. For comparative analysis, the charts below present information from 1995 onwards for both the US and the EU (treated as an aggregate of its member states), showing some interesting facts (the OECD definitions are reported):

a) *General public services* includes: Executive and legislative organs, financial and fiscal affairs, external affairs; Foreign economic aid; General services; Basic research; R&D general public services; General public services not elsewhere classified (n.e.c); public debt transactions; and Transfers of a general character between different levels of government.

[6] More info on COFOG accounting methodology: https://ec.europa.eu/eurostat/web/products-manuals-and-guidelines/-/ks-qq-19-010

[7] https://data-explorer.oecd.org/vis?df[ds]=DisseminateFinalDMZ&df[id]=DSD_NASEC10%40DF_TABLE11&df[ag]=OECD.SDD.NAD&dq=A.JPN%2BFRA%2BUSA%2BGBR%2BDEU%2BITA.S13...OTE..GF0108%2BGF0107%2BGF0106%2BGF0105%2BGF0104%2BGF0103%2BGF0102%2BGF0101...V..&pd=1970%2C2022&to[TIME_PERIOD]=false

These expenditures shares tend to be stable in terms of *Gn/Y* (where *Gn* is expenditure in a category). In the EU this decreased since 1995 from about 9% to less than 6%, and is now close to the US, which is almost 7%.

b) *Defense* (including Military defence; Civil defence; Foreign military aid; R&D defence; and Defence n.e.c.) considerably decreased in the US from over 7% in 1970 to 3% 2023, and in the EU from slightly more than 2% in the mid 1990s to 1.3% (but it is increasing to about 2% in the next years, after Russia invaded Ukraine)

c) *Education* covers: Pre-primary and primary education; Secondary education; Post-secondary non-tertiary education; Tertiary education; Education not definable by level; Subsidiary services to education; R&D education; and Education n.e.c. This expenditure is stable at about 5.4% in the US and at 4.7% in the EU.

d) *Economic affairs* includes: General economic, commercial and labour affairs; Agriculture, forestry, fishing and hunting; Fuel and energy; Mining, manufacturing and construction; Transport; Communication; Other industries; R&D economic affairs; and Economic affairs n.e.c. In the US for most years this aggregate was close to 4% historically, now is 3.2%. In the EU the current share is 5.8%.

e) *Housing community and amenities* cover: Housing development; Community development; Water supply; Street lighting; R&D housing and community amenities; Housing and community amenities n.e.c. In the EU, with some oscillations, the share was and is about 1%, twice the US.

f) *Public order and safety* covers: Police services; Fire-protection services; Law courts; Prisons; R&D public order and safety; and Public order and safety n.e.c. In the US the share doubled from 1% to 1.8%, and in the EU the share is currently 1.7%

g) *Social protection* includes: Sickness and disability; Old age; Survivors; Family and children; Unemployment; Housing; Social exclusion n.e.c.; R&D social protection; and Social protection n.e.c. It is now 7.9 % in the US, while in the EU it is about 19.1% of GDP

h) *Health*, which includes: Medical products, appliances and equipment; Outpatient services; Hospital services; Public health services; R&D health; and Health n.e.c. in the US was less than 3% in 1970 and increased to around 10% in 2023, while the share in the EU increased from 6% to about 7% in recent years

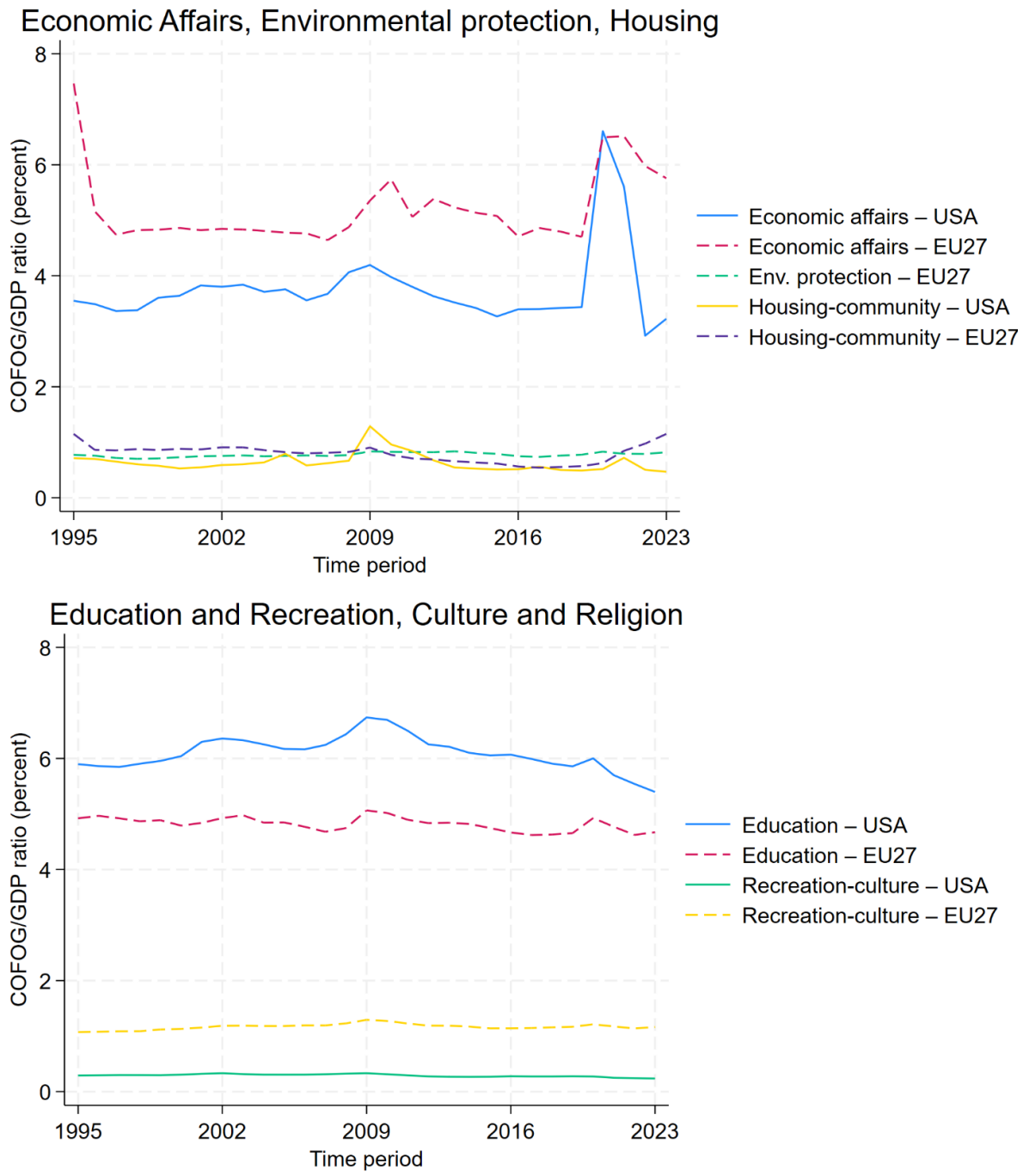
i) Other minor items are included in *Environmental protection* (includes: Waste management; Waste water management; Pollution abatement; Protection of biodiversity and landscape; R&D environmental protection; and Environmental protection n.e.c.) and *Recreation, culture and religion* that includes: Recreational and sporting services; Cultural services; Broadcasting and publishing services; Religious and other community services; R&D recreation, culture and religion; Recreation, and culture and religion n.e.c. Cumulatively, EU expenditure for both these aggregates is approximately 2% of GDP. In contrast, the US does not report expenditures under the environmental protection category (which does not imply the complete absence of such expenditures, but another way of classifying them), and its expenditure on recreation, culture and religion is only one-fifth of the EU's level.

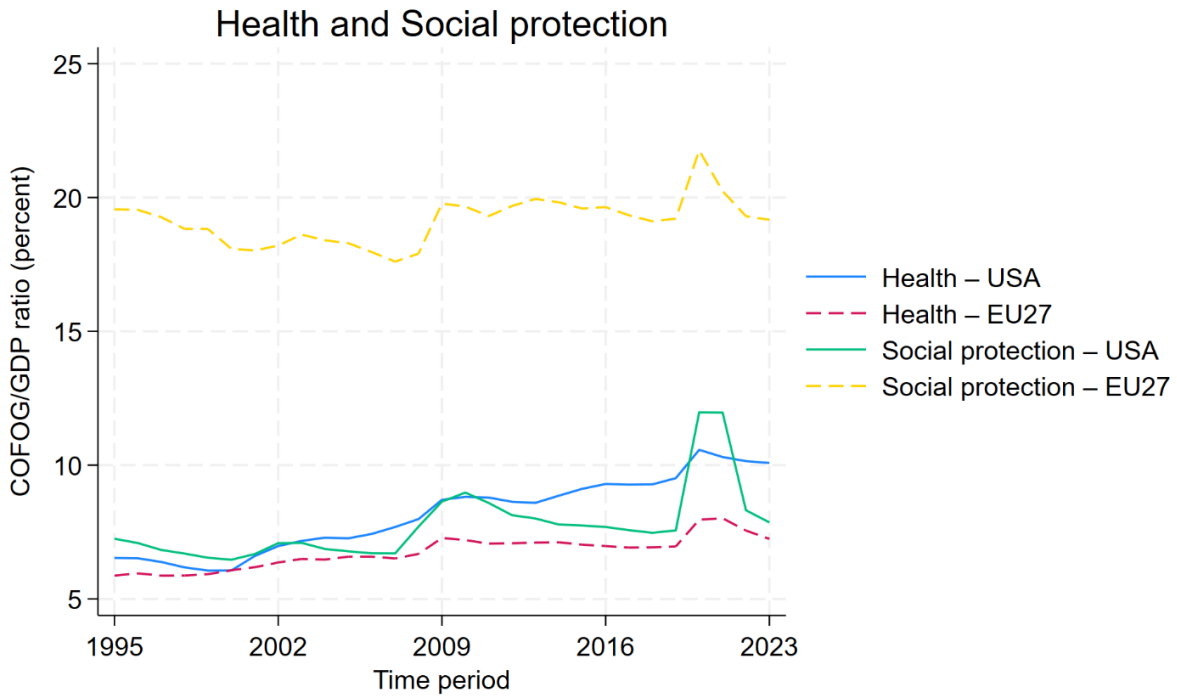
These figures suggest two simple facts: firstly, a clear similarity of the government expenditures in proportion to GDP, despite the quite different social model between the EU and the US. When there are historical differences between EU and US, they slowly tend to converge over time. Secondly, while G/Y increased substantially over time, their shares in the overall portfolio of government activities are relatively stable: change - if any- is slow.

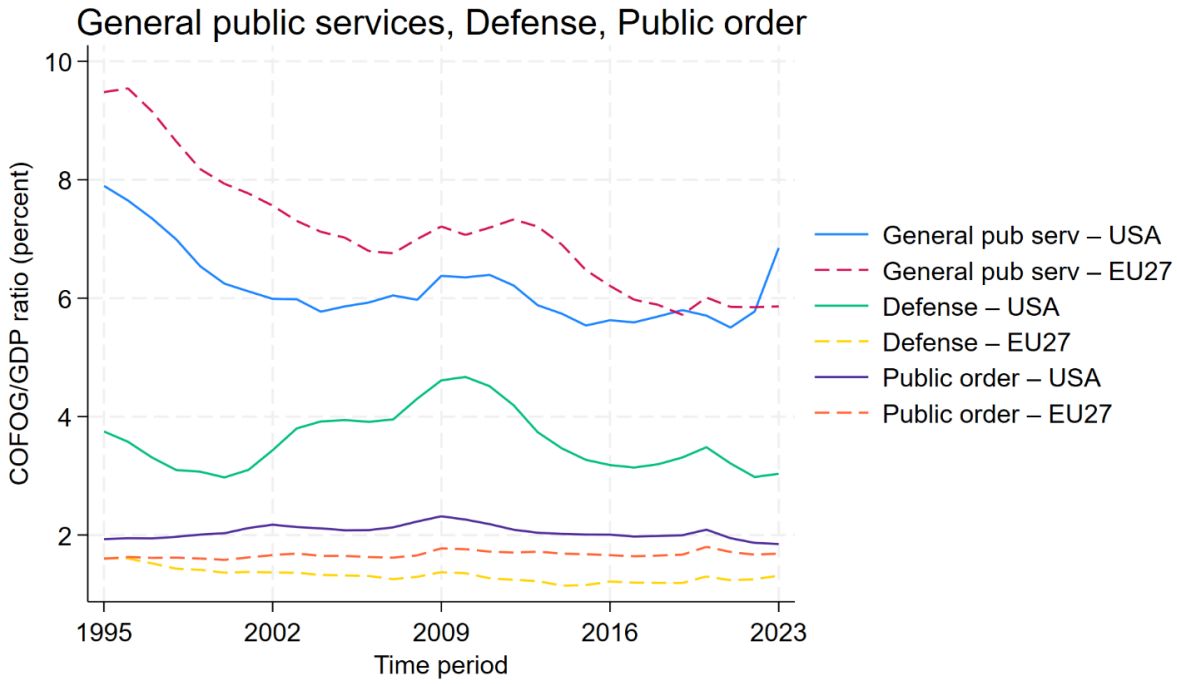
An implication of these two simple facts is that, whatever the institutional differences and the change of historical and geo-political circumstances, there are in the G7 (as in other developed market economies) some drivers on the demand side of services provided by government that support a relatively stable pattern and a convergence mechanism. In other words, it is not just that

G/Y is converging over time, but also that its underlying pattern is more convergent than one would expect across regions.

Figure 8: US COFOG 1970-2022, share of GDP and of General government expenditures




Health and Social protection
COFOG/GDP ratio (percent)
25
20
15
10
5
1995
2002
2009
2016
2023
Time period
Health – USA
Health – EU27
Social protection – USA
Social protection – EU27

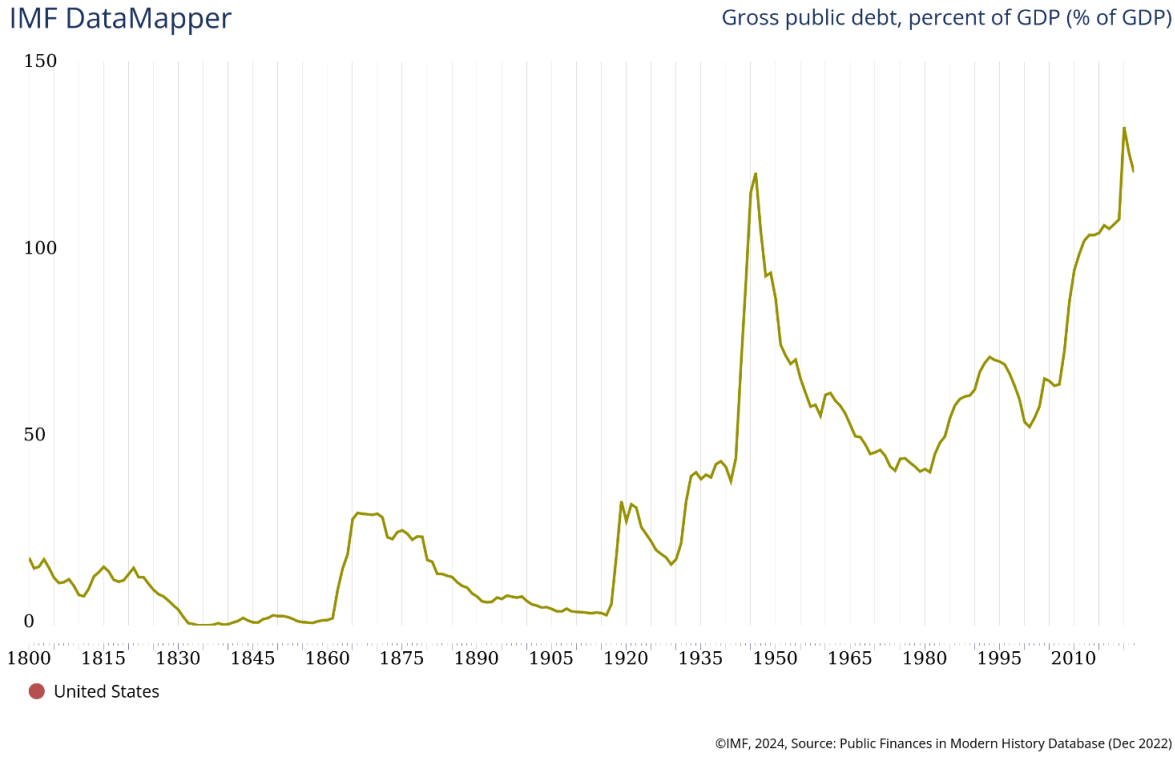

General public services, Defense, Public order
COFOG/GDP ratio (percent)
10
8
6
4
2
1995
2002
2009
2016
2023
Time period
General pub serv – USA
General pub serv – EU27
Defense – USA
Defense – EU27
Public order – USA
Public order – EU27

6 Looking into the Future

Is this (conditional, given the starting points) convergence among the G7 of aggregate G/Y and Gn/Y leading to a stable, sustainable equilibrium? The answer is probably negative.

Public debt is a mechanism to delay the steady state of taxation and expenditure. Figure 9 shows the trend for the US: debt fluctuates to low levels until WWI and the 1920s, increases continuously until WWII and while it decreases relative to GDP between about 1950-1980, it is now back to WWII levels, and beyond.

Figure 9: US Gross public debt, percent of GDP 1800-2022



If the taxation constrains it, public expenditure growth will stop the process at about 40-50% of GDP, but the drivers of further growth are still working. Ageing is a notable example, pushing upside public pension and health entitlements. But if education, protection of the environment and adaptation to climate change, health, and several items are superior goods, and income per capita increases, there will be an increasing gap between demand and supply of goods provided by the state. This gap is increasingly filled by public debt and divestitures of government-owned assets, leading to an impressive decumulation of public sector net worth (the balance between government assets and liabilities, including public corporations). A recent contribution on this issue are Ball et al (2024), Koshima et al (2021) and below we draw from and elaborate on their work. In turn, they draw from IMF Data: Public Sector Balance Sheet[8], which are now available for 55 countries.

On average, around 2020, total public sector (financial and non-financial) assets for 24 countries (a quite heterogenous array spanning from Japan to Kazhakistan, or from Mexico to Mongolia) considered by the IMF data, are worth 284% of GDP, with high variance, mostly depending upon

[8] https://data.imf.org/?sk=82a91796-0326-4629-9e1d-c7f8422b8be6

mineral reserves. Within this, infrastructure is 70% of GDP on average, while the financial assets are worth about 100% of GDP in countries as the US or UK, including assets by state-controlled banks and the central banks. Such financial assets are usually balanced by liabilities. On average for these countries total liabilities are 181% of GDP, in turn including securities, pension obligations, deposits and currency. Hence the net public sector worth (including SOEs, see below) would be in the region of 100% of GDP (Ball et al 2024, Ch.9).

See Figure 11 for the concept of a public sector balance sheet.

As our focus is on the G7, which account for about 30% of global GDP[9] , we report some IMF figures about their net worth position, which, as we shall see, is a useful way to discuss the sustainability of public expenditure (and debt) trends in the future.

Total assets for the G7 vary from a maximum of 378% in Japan (154 % fixed assets, particularly transport infrastructure; 194% financial assets) to 144 % in UK (39% fixed, following privatizations and low public investment; 82% financial). Turning to liabilities, there is indeed also large variability, with Japan having outstanding securities 128% of GDP, while Germany less than half (61%). The range for public pensions is wide: just 14% for Canada and 84% for Italy.

The available information for the G7 can be collapsed in just figure: the Public Sector Net Worth as percentage of GDP. The only country with a substantially positive PSNW is Canada, with about 70%. Japan is just above zero, and Germany just below. Italy is in the worst position, about -170%, but UK is the second worst at about -100%. France and the US are also in the negative. These outcomes were the result of a number of factors, including the Global Financial Crisis of 2008, sluggish growth, and other shocks (the economic effects of the Covid pandemic and Ukraine and Gaza wars were not yet accounted for, but they have worsened the scenario).

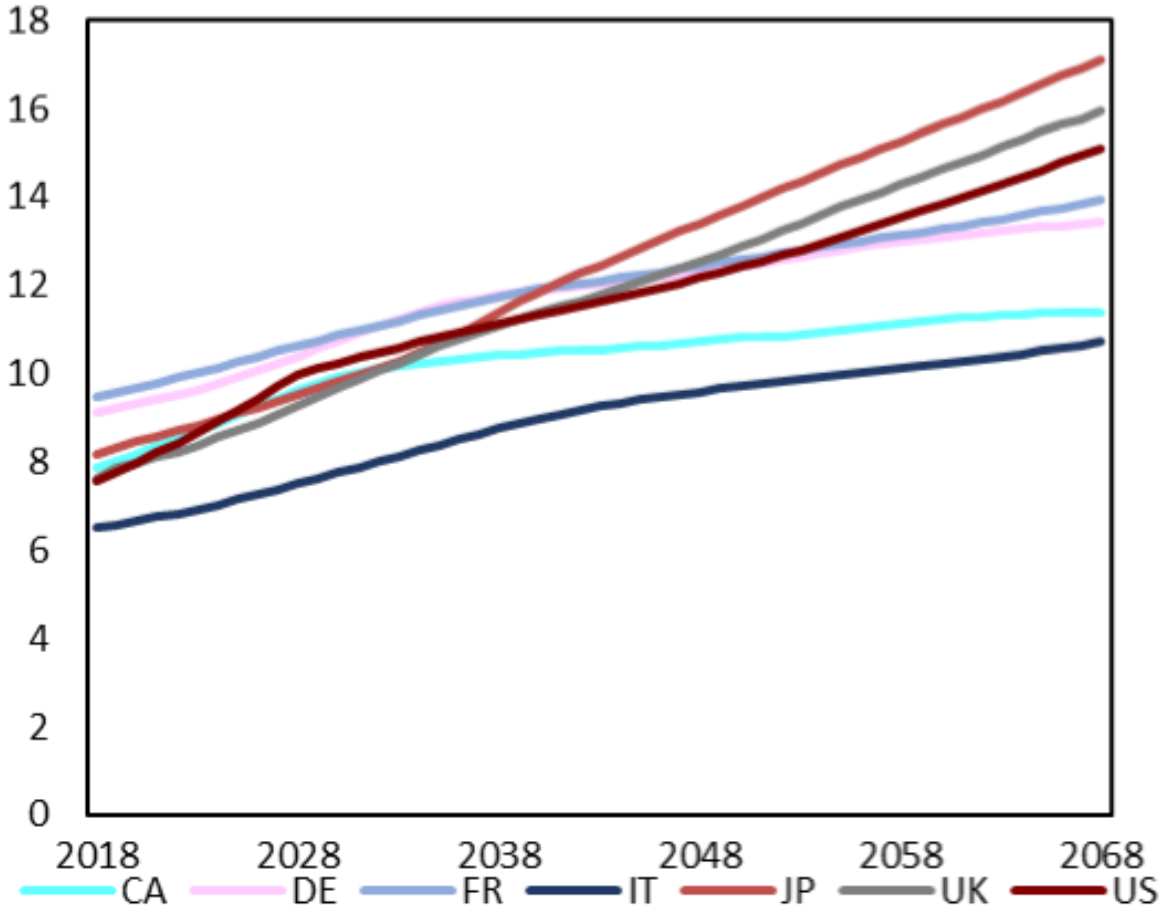
With such limitations, the IMF model (Koshima et al 2021, Ball et al 2024) provide some projections based on demographic trends and their impact on employment and growth; taxation at ongoing policies; constant G_n/Y except health and pensions, the latter driven by demography and anticipated benefit entitlements, age structure and for health growth trend of expenditure. Nothing is assumed in terms of increasing public expenditures for climate change, which implies an underestimate of what is needed in the next decades.

With these quite strong limitations the overall projected health expenditure 2018-2068 will increase considerably everywhere in the G7 (Koshima et al 2021,15):

> "The rise of health spending is driven by fast growth of per person health spending... Japan is projected to have the largest increase in health spending by almost 9 percentage points of GDP between 2018 and 2068, followed by UK, where health spending is projected to increase by 8 percentage points over the same period. Other countries are not far behind, with the health spending projected to increase by 3 percentage points in Canada, the lowest increase among peers. In contrast, pension spending is projected to remain at its current level or increase only modestly in most countries... This is due mainly to the existing pension policy that counteracts pressures from population aging by increasing the retirement age and reducing the replacement rate."

[9] https://www.statista.com/statistics/1370614/g7-country-gdp-share-world/we

Figure 10: Projections of Health Expenditure (Percent of GDP)



Source: Koshima et al. (2021)

Looking at a more restricted metrics, the Intertemporal Financial Net Worth (INFW) that (the label may be misleading) does not include non-financial assets, all the G7 countries have a negative balance in 2018 and in a time horizon of 50 years are expected to considerably worsen their position. The US would reach close to -400% INFW of GDP, UK about -350%, France and Japan between - 250-300%, Canada, Germany, Italy between -170-220%. The ranking of worsening perspectives is not changed if non-financial assets are included, with again the US and the UK expected to incur in very large negative public wealth.

Finally, the IMF model suggests the magnitude of the fiscal adjustment required either to move to a INFW of zero or to go back to its current level. The former would require huge adjustments for US and UK of about 10% for Japan 8% of GDP, and 2-3% for the remaining countries.

According to Koshima et (2021, p 30):

> "... **on current policies, all G7 countries fall well short of their respective intertemporal budget constraints**. The average INFW across the G7 is minus 267 percent of GDP, with none of the countries having sufficient fiscal resources to meet their spending promises under current policies...Among the G7, US shows the largest shortfall, with an INFW worth of minus 392 percent of GDP, and Canada the smallest, at minus 170 percent of GDP. These shortfalls are driven by negative NFW at the outset (i.e., they countries currently already owe more than they own) and growing future health obligations in light of population aging. Closing these gaps would require adjustments to the primary balance of an average of almost 7 percent of GDP."

If the objective is less ambitiously to *stabilize* the INFW, still the US would need to increase taxation and/or cut expenditures by 6.5 %. If non-financial assets are included in the definition of a zero

target, and nothing is cut in expenditures, still US and UK would need to increase taxes by 10-15%. In the words of Ball et al 2024 (p.144):

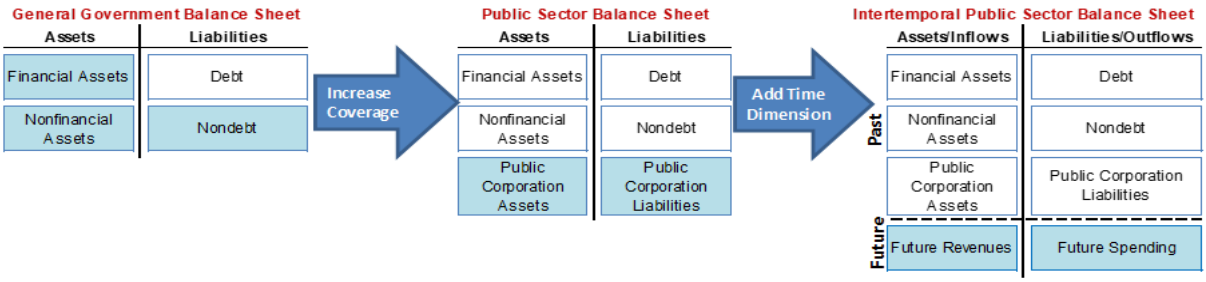
> "The IMF-derived analysis of G7 comprehensive balance sheets demonstrated a clear need for future 'fiscal consolidation' – lower service levels or higher taxes for a multi-generational period… However, both political game theory – the misalignment of benefits and costs inevitable in a system which aims to raise taxes on a progressive basis – and practical consideration demonstrate that over the history of the welfare state and especially over the last generations or two, the tendency has been to consume benefits now and to pay later. Somehow, this has to be reversed"

With all due consideration of the limitations of these projections and of fixing an adjustment target in a rather arbitrary way, we agree. Our own simple empirical model suggests that fiscal resistance is already constraining the level of public expenditure in such a way that the welfare state may be at risk.

How would be possible to change the fiscal trajectory and at the same time preserve the desirable feature of government and the welfare state in contemporary democracies? In the next and concluding section we briefly elaborate on this question.

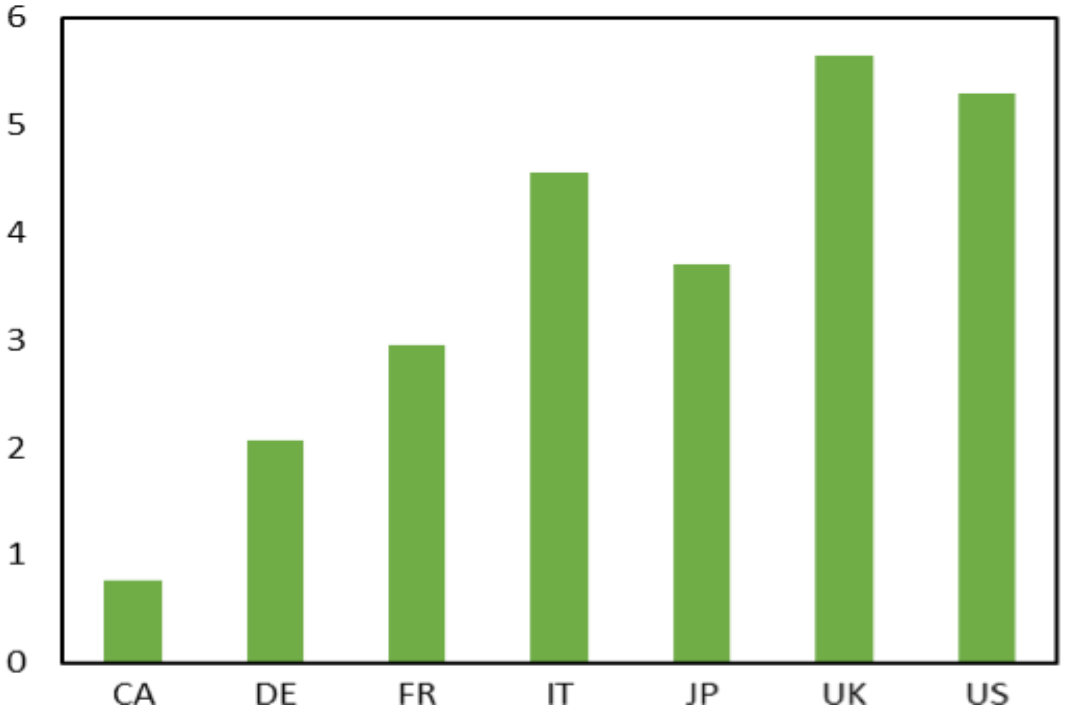
Figure 11: The public sector balance sheet

The public sector balance sheet extends coverage to public corporation and includes future revenues and spending.



Source: Koshima et al (2021)

Figure 12: Size of Adjustments to Make INW 0 (Percent of GDP)



Source: Koshima et al (2021)

7 Conclusions and Policy Implications

A way forward in order to achieve fiscal sustainability of the welfare state in the XXI century could be a fundamental change in the financing mechanism of the state, with greater reliance on non-tax revenues. These may arise from management of existing public wealth, and its further accumulation. These revenues may include dividends from equity investment either through state-owned enterprises, national wealth funds, sovereign wealth funds, rents on certain tangible and intangible assets, such as land, natural resources, space, ITC and other infrastructure and services, some knowledge-based activities. The current system of intellectual property rights is often asymmetrical: governments give away for free or for modest returns the assets thew own or their services, these are then captured by private business, often in the form of oligopolies. While these oligopolies are highly profitable, in fact corporate or indirect taxation is too little and too late to ensure a fair dividend to the taxpayers, particularly because of tax evasion, tax elusion, or successful lobbying by such vested interests in order to obtain protective legislation or other indirect tax-exemptions or subsidies (Florio 2023).

Assets owned by governments are indeed still important and include, with variations across countries, toll roads, rail, airport and ports, energy utilities, water, banks and insurance, buildings, land, and much more. According to Ball et al (2024) in the US real estate portfolio owned by the cities of Boston, Los Angeles, Chicago have values alone in excess of 750 USD billion. According to some IMF estimates overall government-owned assets may be worth 200% of global GDP, not including real estate, which may be in the zone of 100% of GDP. The efficiency loss of inadequate management of such government-owned assets may be up to 4.5% of GDP (Ball et al 2024, p 208). This is probably a considerable underestimation of the potential. In spite of large scale divestiture of SOEs in the last decades of XX Century, there is wide evidence that different forms of state capitalism are performing well, not only in China, the core country for this capital accumulation mechanism (Del Bo et al 2025). Sweden, indeed a country with very different institutions, or France, created government agencies with a remit to efficiently manage public assets, including SOEs. Some national public wealth funds round the world have a good track record of active management of operational assets. Sovereign wealth funds as well have been able to provide good returns to the taxpayers with financial investment in large portfolios. Interestingly, President Trump signed an executive order[10] (to create a US sovereign fund (probably rather a national fund) of federal scope (while it is reported that 23 state level sovereign funds are already existing in the US, from Alaska to Texas, manage 332 billion US assets). The stated objective is:

> "The creation of a sovereign wealth fund for the United States will help maximize the stewardship of our national wealth. Sovereign wealth funds exist around the world as mechanisms to amplify the financial return to a nation's assets and leverage those returns for strategic benefit and goals. The United States can leverage such returns to promote fiscal sustainability, lessen the burden of taxes on American families and small businesses, establish long-term economic security, and promote U.S. economic and strategic leadership internationally. The United States already holds a vast sum of highly valued assets that can be invested through a sovereign wealth fund for greater long-term wealth generation."

The interesting point is that the objective, as it is stated, is not divestiture of assets, as may have been expected (and as was largely done with privatization policies in the UK and elsewhere, Florio 2004), but investment for 'long-term wealth generation'. Thus a source of revenue for government.

[10] https://www.whitehouse.gov/fact-sheets/2025/02/fact-sheet-president-donald-j-trump-orders-plan-for-a-united-states-sovereign-wealth-fund/

Is not the place here to further discuss the potential additional revenues for governments of better management of their wealth, in the G7 or elsewhere. There is scarce doubt that a strategy aimed at providing non-tax revenue to governments may counteract the increasing burden of taxation, real or perceived, by those who pay more to the state than the value of the services and transfers they obtain (for a discussion see Florio 2026).

The only alternative to find such an adjustment mechanism would be the rather draconian one announced by Elon Musk: dramatically cutting public expenditures. Going back to government expenditures at around 30% of GDP in the US is resetting the clock to 1965 and would imply a fundamental revision of the composition and level of public services. Looking at the Table 5, it is everyone guess how this could ever be achieved, considering that certain expenditures, such as interest on past public debt and other contingent liabilities, including pensions, and certain core state activities cannot be cut without de facto announcing a default, disrupting the international and internal credibility of government, which -after all- is its most important asset.

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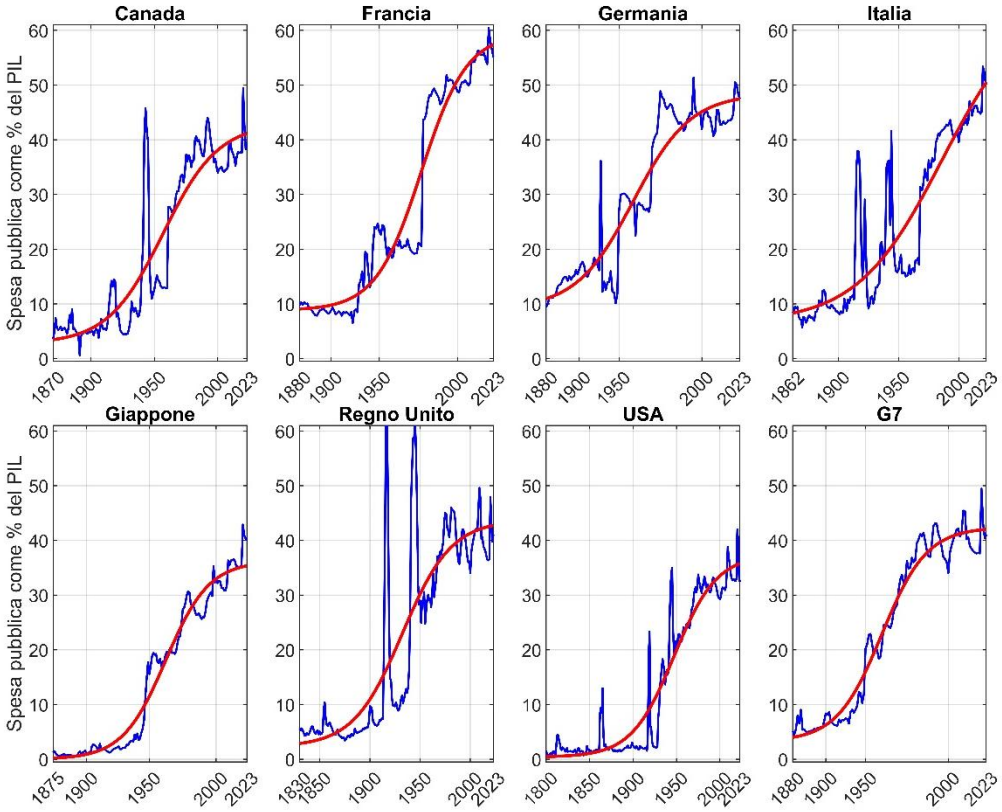
Appendix 1: On further research

Further research should deal with several issues, mostly raised by participants in the SBCA Conference 2025 and particularly by Kerry Krutilla (private correspondence with M. Florio, the usual disclaimer applies).

1. If the marginal utility diminishes as the consumption of goods increases, this would be another brake –beyond the marginal cost of public funds -- to the Wagner proposition that public goods increase more than proportionately to income. There is an analogy in the well known shape of the Kuznets curve literature, beyond a GDP tipping point. This seems, however, related to the composition of public goods provided by government, and it is not obvious that the marginal utility decreases in the same way for all goods.
2. The assumption that $Y(t)>0$ is compatible with different growth models, both in the exogenous and endogenous theory literature. The simplest mechanism is embedded in the model by assuming that knowledge increases over time and has a positive impact on total factor productivity, but given the long run we consider, there may be other factors related to capital accumulation and labour force.
3. Our model does not assume a public-good- specific technical progress, but just an average effect on growth, which of course can be lead by different sectors in different times. Public expenditures are indeed mostly related to monetary transfers and to provision of services, each with its own trajectory of social benefits and costs. Of course Wagner's law assumes a relationship between government spending and government service delivery. The superior goods are the services, not spending per se (particularly not transfers). This opens the issue of a more detailed analysis that would break down the Wagner's law in a set of empirical associations.
4. Our model, as in Wagner, does not consider change in relative prices between privately and publicly provided goods. This issue is to a certain extent related to the 'Baumol disease', that we cannot discuss here. In general we believe it is an exaggerated concern, because of its static definition of what a good is. Health provision, for example, experienced such large technological progress, and is so important in public spending, that hardly can be considered a stagnant sector. In fact efficiency drivers in the economy that increase Y, like exogenous technical change, may also increase service delivery in the government (internet and AI might increase labor productivity both in public and private sectors alike).
5. The assumption G=T does not assume "Ricardian equivalence", i.e., equivale ence of bond and tax financing. It is a simplification, and a general model should consider that governments incurring in debt (and seignorage) can probably somewhat shifts in the future the Pigou effect (this is the case of Italy, that for many years delayed the 'brake' effect of taxation, hence has a less pronounced S in the G/Y trajectory)

Appendix 2: Updated trajectories

Figure 13: The ratio between public expenditure and GDP (1800–2023)



Source: Bastianin et al. (2025). Data source: IMF.

The figure shows the trend of primary public expenditure as a share of GDP from the first available year to 2023 for seven countries and for the G7 group. The S-shaped line represents an estimate of the long-term evolution, obtained using a four-parameter logistic model.