

Working Paper 1/2020

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Owner, editor and publisher:
Federal Ministry of Finance
Johannesgasse 5, 1010 Vienna
bmf.gv.at

Responsible for the contents: Federal Ministry of Finance,
Division III, Department III/1 – General economic policy

Photos: Adobe.stock

Layout: printing facility of the Federal Ministry of Finance
Vienna 2020



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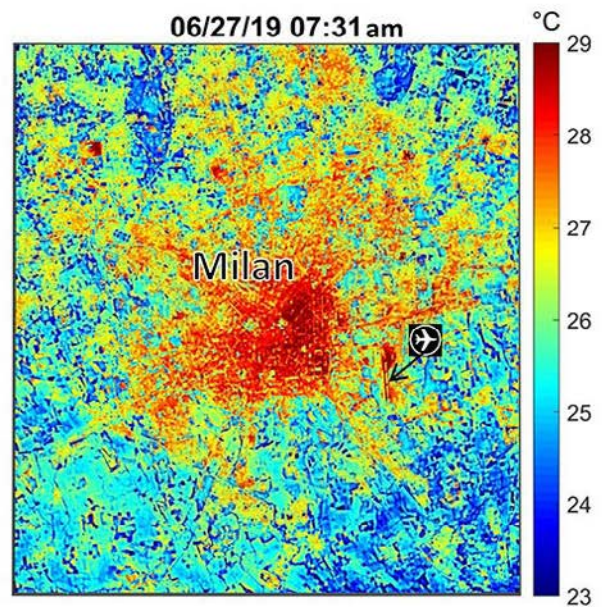
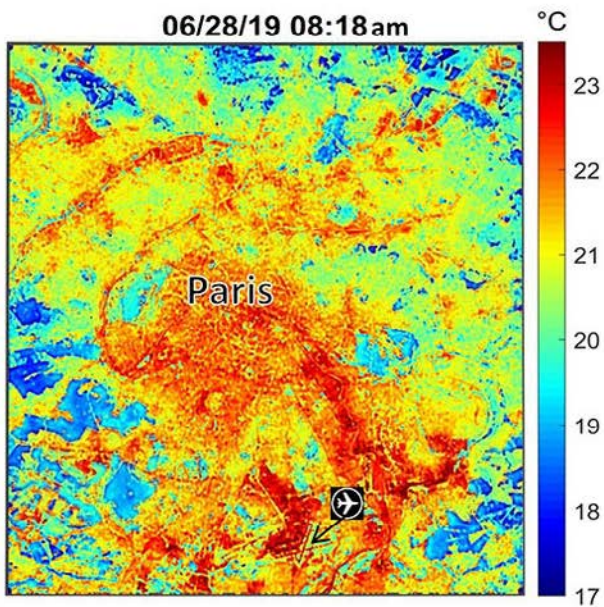
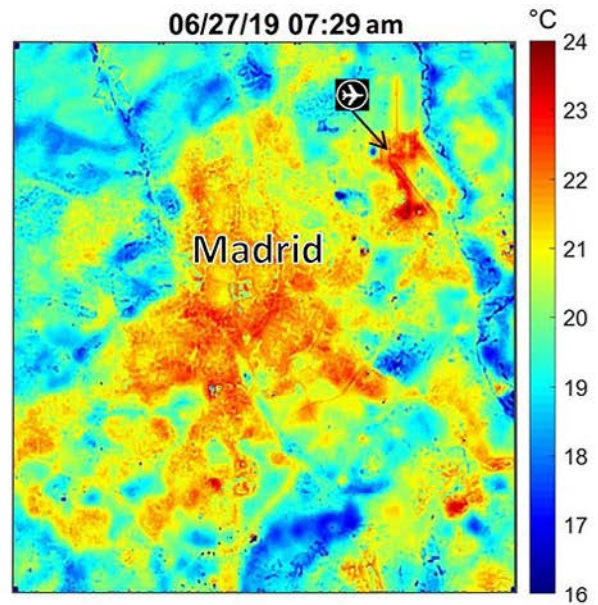
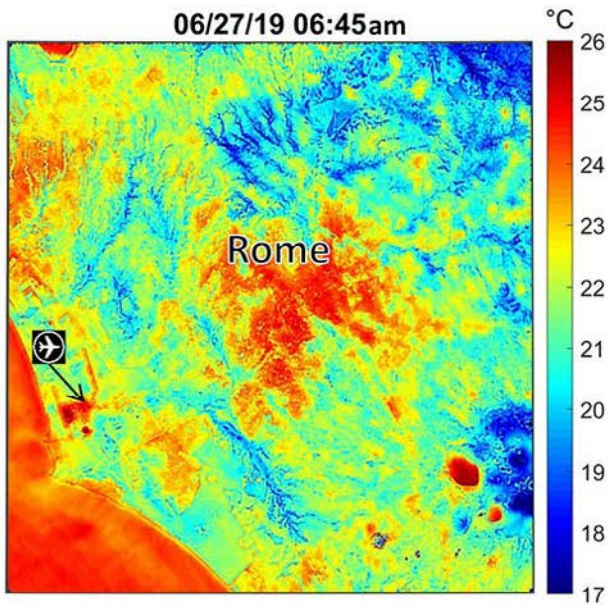
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Growth in federal states – a bird's eye view



Source: NASA

The views expressed in this working paper are those of the authors and do not necessarily represent the views of the Austrian Federal Ministry of Finance.

Abstract:

In our analysis we assess whether state, territorial and provincial economies in federations with a genuine political union and a sizeable central budget fared better than the Euro area Member States during the two recessions since the beginning of the new millennium. For this comparison we shift the view and look at the Euro area as if it were such a genuine federal state and treat its Member States like states, territories or provinces in the United States of America, Australia and Canada. For the assessment we analyse convergence patterns of state economies as well as their resilience to economic shocks. Our findings do not support the call for a central budget for the Euro area as proposed by several international institutions.

JEL Classification Numbers: E32, F15, F36, F45, O47

Keywords: Convergence, resilience, federal states, Euro area, Optimum Currency Area

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Introduction

All happy families are alike; each unhappy family is unhappy in its own way.

The introduction of the Euro as a single currency in at the time twelve Member States of the European Union in 1999 (and 2002 as a physical currency) created the largest monetary union outside a political union in the world. The discussions whether the Euro area would already constitute or potentially converge to an optimal currency area (*OCA*) have not concluded since. The so called *Anna Karenina principle* – quoted above – from Tolstoy's book of the same title (1878) basically states that an insufficiency in any one of a number of factors leads an undertaking to failure. Consequently, a successful undertaking is one where a number of complex problems are solved together. Following this line of thought, we take a look at seemingly successful families of federal states, provinces and territories in the United States, Canada and Australia and try to identify whether the lack of central fiscal instruments constitutes such a deficiency that may be responsible for the Euro areas relative economic underperformance (whether the population of a country can be considered a happy family or not remains for political scientists to be answered).

One core argument that is repeatedly brought forward to explain the Euro areas relatively sluggish recovery in the past decade following the Great Financial Crisis (*GFC*) relates to the design of the monetary union for which its architects did not foresee a Central Fiscal Capacity (*CFC*). Today the debate on a possible Euro area budget is no longer confined to academics and political economists but also top notch on the political agenda of European policy makers. In order to assess its potential impact on the Euro area and its Member States several studies try to simulate a fictional growth path of Gross Domestic Product (*GDP*) for Euro area countries under the assumption of a central fiscal shock absorber. Proposals for how to structure such a shock absorption capacity are numerous. The Chief Economist of the German Federal Ministry of Finance (together with Dullien et al. 2017), the German Council of Economic Advisors (Andritzky at a joint Conference in 2018 or in its *Jahresgutachten 2018/19*), Bercy the French Ministry of Finance (2017) just to name a few, they all discussed and developed ideas surrounding a centralized stabilization function either for investment or central unemployment insurance. Experts from the *European Stability Mechanism (ESM)* (2018), the *International Monetary Fund (IMF)* (2018), Beetsma in joint work with the *European Central Bank (ECB)* (2018), the *European Commission (COM)* (in its so called *Nikolaus package* from December 2017) worked on different hybrid concepts of a shared rainy day fund with inter-temporal budgetary transfers that should finally be broadly balanced over the long run and thereby

avoid moral hazard and permanent transfers. Katterl (2019) considers risk and rating based contribution keys for a hypothetical – small scaled – Euro area budget for this purpose. Experts from the Dutch Ministry of Finance argued in a blog post on VoxEU (2018) that Member States that comply with their national Medium Term Objective for a structurally balanced budget do not require any outside fiscal support and that private risk-sharing via the financial markets is very much underdeveloped in the Euro area.

European institutions are fully aware of all of this. There are already different instruments to foster convergence and cohesion such as loans from the *European Investment Bank (EIB)*, the *European Social Fund (ESF)* or more generally economic policy coordination under the *European Semester*. In addition, further reforms in a number of areas regarding the functioning of the Euro area are being discussed or already in the process of implementation¹. Chief among them are the introduction of a *European Deposit Insurance Scheme (EDIS)*, the reform of the ESM and a *Budgetary Instrument for Convergence and Competitiveness (BICC)* (see Council 2019). A central Euro area BICC would be a step in the direction of centralization of fiscal policy, in order to be in a better position for coordination of fiscal and monetary policy. The BICC is intended to reward reforms and investment at a national level, while institutions, such as the ESF, are focused on a regional level.

In our view many studies on the potential impact of a central budget function compare apples and oranges. Therefore, this paper follows a somewhat different approach by looking at the issue from a different – *a bird's eye* – perspective. In order to be able to analyse other federal countries and the Euro area on the same terms, we shift the level of aggregation to achieve a true *apple-and-apple*-comparison. By doing so, the currently essentially fiscally independent Euro area Member States become, for one second, hypothetical regions of a fictional political union with a central budget. The principal questions we wanted to answer are whether other federations fare better in terms of real GDP per capita convergence and its ability to recover from common shocks **on a state, territorial or provincial level** as compared to Euro area Member States. The inspiration for this paper dates back to the 2017 Article IV consultation of the Euro area in which the IMF looked amongst others into regional convergence patterns within Germany and Italy. Braml and Felbermayr (2018) took a similar approach as we do, though, looking at the EU as a whole instead of the Euro area and at nominal household income after transfers instead of real GDP per capita. Furthermore, our analysis builds on a far wider set of regional and federal data for Australia (**AUS**), Canada (**CAD**), the United States of America (**USA**) and the Euro area (**EA**).

¹ <https://www.consilium.europa.eu/de/press/press-releases/2018/12/04/eurogroup-report-to-leaders-on-emu-deepening/>

We use data for real GDP per capita (*p.c.*) in purchasing power parities (*PPP*) in international United States Dollars (*USD*) from the Organization for Cooperation and Development (*OECD*) database for federal as well as state, provincial and territorial levels. This indicator provides information on GDP growth and reflects on changes in population as well as price developments, thus, covering a broad range of relevant factors for economic policy makers.

The paper is structured as follows:

Chapter 1 provides an overview over provincial and federal revenue as well as expenditure structures to elaborate on the different degrees of fiscal integration in the peer blocks. The question is approached via aggregate OECD data for state and central government finances.

Chapter 2 then establishes some stylized facts and provides a simple analysis of growth patterns within the four peer blocks. We use data for the four country blocks to test for two hypotheses: **(1) Regional income levels in federations with a significant central budget converge differently. (2) Regional income levels in federations with a significant central budget recover faster from common shocks.** Regarding hypothesis (1) the paper follows a simple approach using Ordinary Least Squares (*OLS*) for panel data with a fixed effects estimator to establish whether or not economic growth at sub-federal level actually leads to income convergence. Regarding hypothesis (2) we apply simple stylised indicators for maximum output loss as well as for the years it took for each state, province or territory until regional real GDP per capita in PPP reached pre-crisis levels again. Finally we look into in/equality of sub-national income distribution. A summary of the main findings can be found in the Annex.

Chapter 3 concludes.

Chapter 1: Revenue and expenditure structures – same same but different?

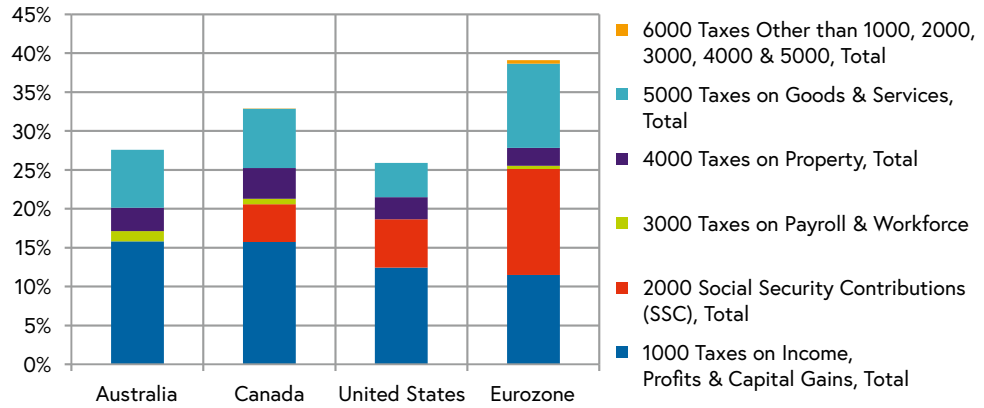
The question that is currently heavily debated is whether a macro-economically significant central budget should be implemented for the Euro area. Its aim would be to stabilize government funding at Member State level and thus provide amongst others for more stable investment also during economic downturns in each Member State. Indeed, for instance, gross fixed capital formation expenditure – which could be used as a proxy for investment activities – has developed quite differently in the four country blocks under consideration during and following recent crises episodes (see *Figure 2* in Annex) and even more different when looking at the levels of provinces, states, territories and Member States.

OECD data for Australia, Canada and the United States government show that revenues from central tax sources appear much more volatile than state and local revenue. It is hard to tell whether different investment patterns in different countries are primarily due to a more volatile tax base or rather the result of different policy choices as illustrated by different taxation and expenditure structures. The data used do not provide any insights into intergovernmental transfers and do not take different concepts of social security financing into account. Financing for social security for instance in most European countries comes mostly from *Social Security Contributions (SSC)*, while it is to a larger extent raised from general tax resources or is simply less developed in terms of size in Anglo-Saxon countries.

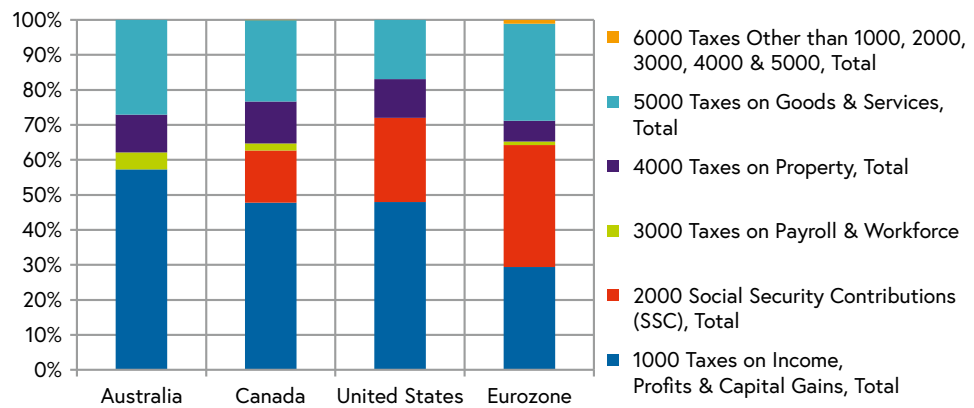
When looking at the different classifications of tax revenues, it meets the eye that Australia has the largest share of taxes on income, profits and capital, whereas the general social security system is not financed by separate contributions from individuals but endowed from general tax resources. In the Euro area zone the largest share of general government revenue comes from SSC, while revenue from taxes on property is lowest.

Graph 1

General government revenue composition (2016 - in % of GDP)



General government revenue composition (2016 - in % of total)

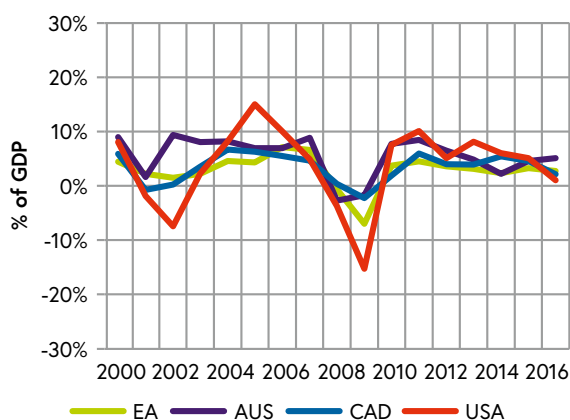


Sources: OECD, own calculations

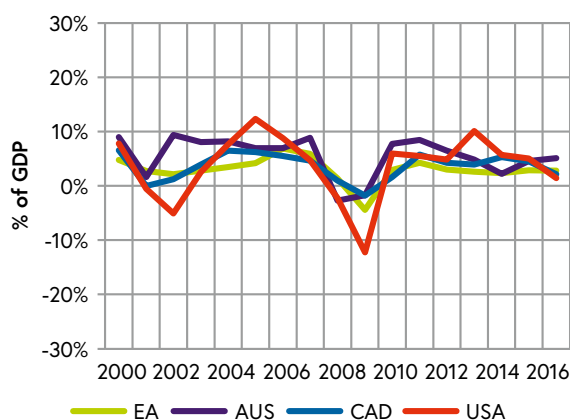
Regarding the volatility of tax revenues, the Euro area on aggregate has a relatively stable income base compared to its peer countries as measured in standard deviation of the annual rate of change.

Graph 2

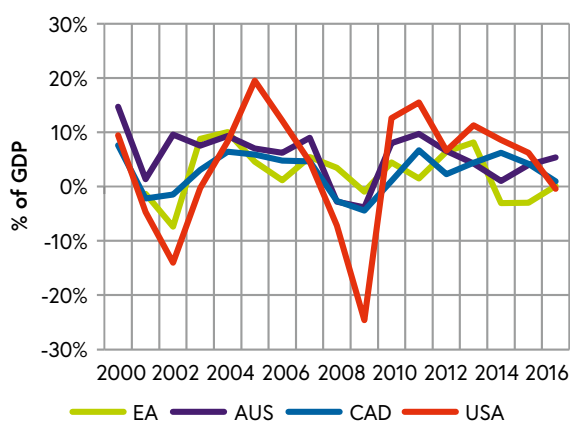
Tax Revenue ($\Delta t-1$) - general gov. excl. SSC



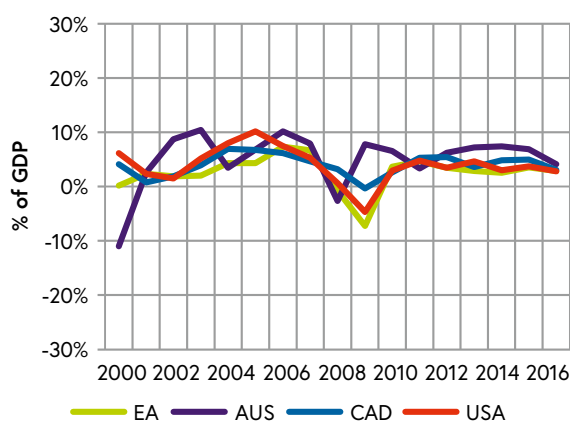
Tax Revenue ($\Delta t-1$) - general gov. incl. SSC



Tax Revenue ($\Delta t-1$) - central level excl. SSC



Tax Revenue ($\Delta t-1$) - state level excl. SSC



Sources: OECD, own calculations

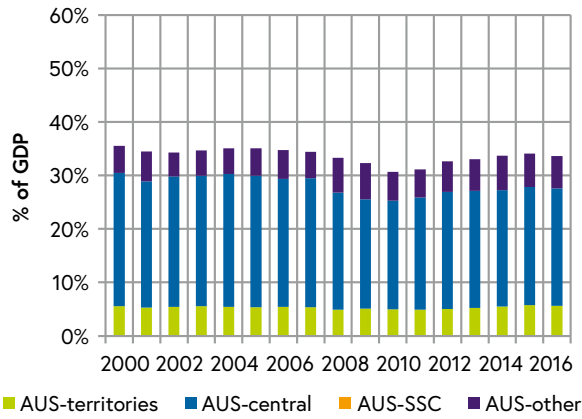
The division between central taxes on the one hand and state and local taxes on the other hand is quite different in all of the four country blocks. In our comparison the central budget for the Euro area is approximated through the sum of contributions of Euro area Member States to the EU budget. It follows under this assumption that state level budgets of Euro area Member States are the remaining revenues not transferred to the central budget.

The aggregate contributions of the 19 Euro area Member States to the EU budget amount to roughly one per cent of GDP on average². In turn Australia has the lowest share of territorial and the highest share of federal taxes (also called commonwealth taxes there).

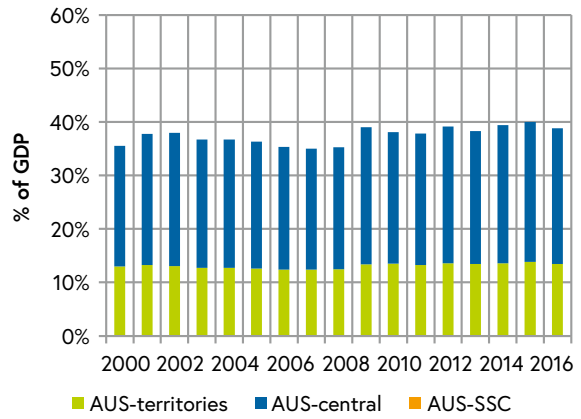
² http://ec.europa.eu/budget/graphs/revenue_expenditure.html

Graph 3

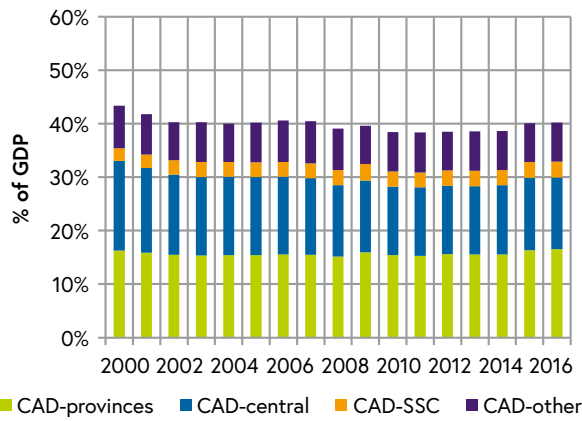
Australia - revenue composition



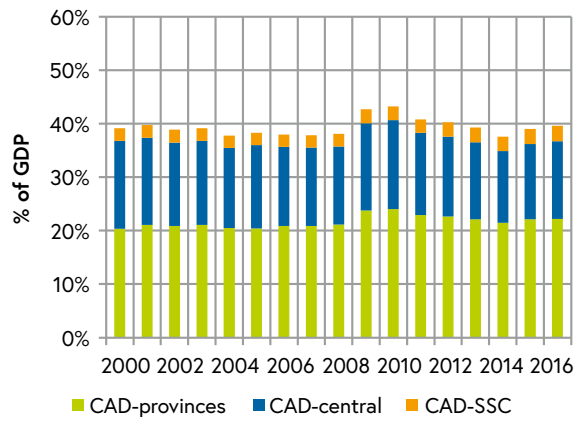
Australia - expenditure structure



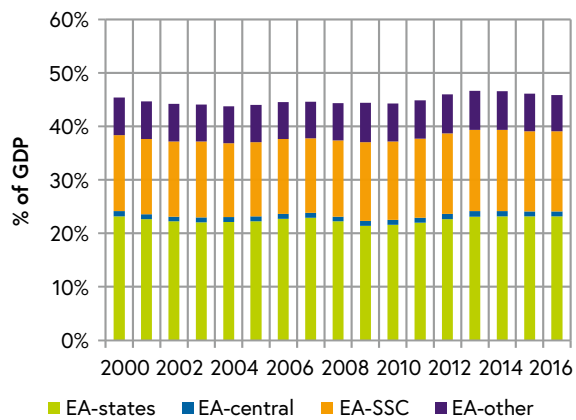
Canada - revenue composition



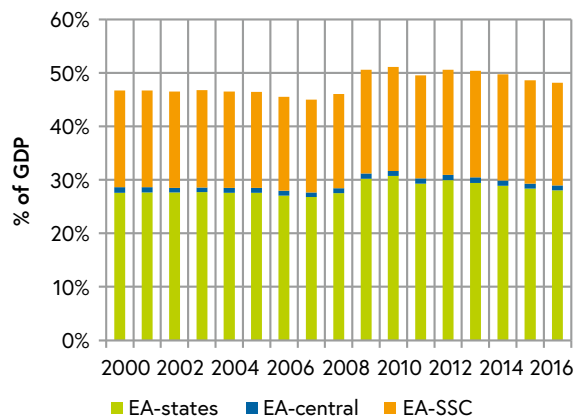
Canada - expenditure structure



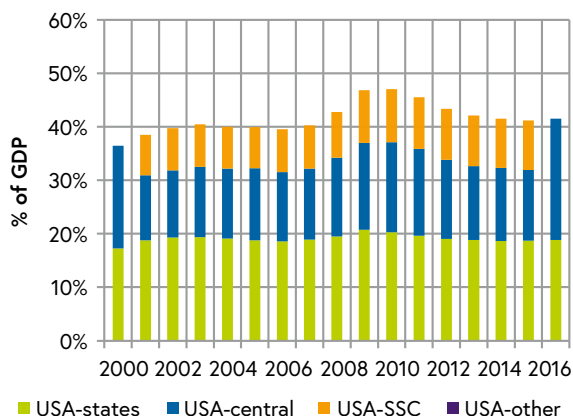
Euro area - revenue composition



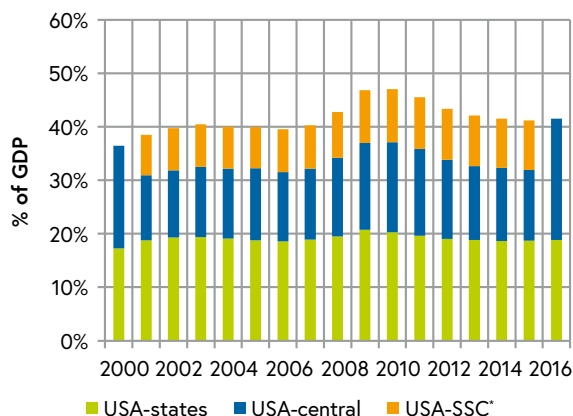
EU area - expenditure structure



United states - revenue composition



United states - expenditure structure



*) data for USA-SSC where available

Sources: OECD, IMF, own calculations

The broader picture of tax composition is strongly diverging among the four blocks. While there are income taxes on both state and provincial as well as on federal level in Canada and the US, the Euro area central budget – if deducted from its current form and in line with current proposals – would be endowed first and foremost from inter-governmental contributions and transfers to the central budget. In contrast, the larger share of revenue in Australia comes from centrally collected commonwealth taxes that are then partly transferred to and spent on the territorial and local level³.

It is important to point out that Social Security is organised quite differently in the peer countries. Some countries have a compulsory insurance system, some not. Some countries provide higher replacement rates than others. SSC are collected on different levels of government and by different institutions. In a nutshell, risk-pools for Social Security Systems are quite different, leading to different patterns of resource allocation and distributions of Social Security benefits in all four peer blocks. These significant differences in contribution payments and benefit entitlements are of utmost importance when looking at the aggregate figures of SSC and when discussing possible options for a Euro area CFC.

For the Euro area as an aggregate, another open question is whether the revenue base of a potentially beefed up central budget instrument would be additional or complementary to the already existing contributions⁴. Considering an overall already quite high

³ <https://www.abs.gov.au/ausstats/abs@.nsf/0/9321627294FABECFCA2583E80013F54C?Opendocument>

⁴ <https://www.consilium.europa.eu/en/press/press-releases/2019/06/14/term-sheet-on-the-budgetary-instrument-for-convergence-and-competitiveness/>

tax burden in most Euro area Member States, it would naturally occur that additional revenue for the centre would have to be shifted from individual Member States via contributions or new own resources. Either way, a central budget would reduce national revenues accordingly and squeeze spending headroom for national governments. By doing so the question would arise, which parts of the revenue base could be moved to the centre in terms of volatility of such tax revenue. Dedicating an unstable source such as a *Financial Transaction Tax (FTT)* or income from carbon credits to the centre would imply an adequate ability to borrow in order to stabilize expenditure.

This description does by no means look into the distribution of revenues and tasks between the different levels of government. The chapter merely gives an illustration of the existence and the size of central budgets. What is interesting from a stabilization need perspective is that in countries with a sizeable central budget, most of the compensation for volatile revenue and expenditure – if any – happens on the central level, where the tax income and expenditure is most affected by cyclical developments. This is quite in contrast to the Euro area, where Member States provide a stabilizing function via their state budgets and Member State government debt, whereas the budget of the EU is not entitled to borrow for financing its current expenditure⁵.

⁵ https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-financial-assistance/eu-borrower/funding-characteristics-eu_en

Chapter 2: Economic convergence and resilience – an odd couple?

2.1 Background

The commitment to a single currency that Euro area Member States made with the introduction of the Euro came with a loss of independent monetary policy instruments at national level. This step brought many advantages, such as reduced real interest rates, transaction costs, no foreign exchange risk and increased price transparency, amongst many others. On the flip side however currency devaluation and targeted interest rates as key instruments for an economic policy response to the business cycle and other major economic shocks were no longer available. Since the ECB's main policy instruments work for every Member State in the same way, Member State's options to adjust were altered considerably. Whatever the difference is between the interest rates set by the ECB and the optimal interest rate for an individual Member State in a particular situation, has to be compensated by either fiscal policy, which remains firmly in the hands of national governments, or investment and structural reforms. As the case of the programme countries has shown during the Euro area crisis, internal devaluation can be a difficult and slow process.

Investment and structural reforms typically only yield in the medium to long term and should in theory lead to Member States economies to converge. This includes business cycle characteristics, such as frequency and amplitude, robustness towards other shocks, or potential growth. Only in a context where these characteristics are somewhat equal can centralized monetary policy be effective. Naturally, one major part of economic convergence is **income convergence**. In order to measure income convergence, we apply standard metrics for (i) so called **β -** and **σ -convergence**, as well as for (ii) **income inequality** measured by the **Theil-index**.

The second aspect in this context we are interested in is **economic resilience**. The World Bank for instance defines macro-economic resilience by (i) **instantaneous resilience**, which is the ability to limit the magnitude of immediate production losses [...], and (ii) **dynamic resilience**, which is the ability to [...] recover⁶.

⁶ <https://openknowledge.worldbank.org/handle/10986/18341>

The literature on economic convergence and partly also on resilience is rich on studies analysing individual federal countries. Just to name a few, Young et al. (2008) found that there is no real convergence pattern among regions and states over time in the pre-GFC era in the US. Brown and Macdonald (2015) looked at the long term convergence pattern of Canadian provinces over several decades and found a split path for two groups of inner-Canadian regions with different convergence paths. According to their findings convergence has not followed a smooth, continuous process, but rather, a series of cycles of phases of convergence and divergence. While provincial incomes tended to converge, there were also periods when incomes diverged corresponding to large external shocks. Afxentiou and Serletis (2000), also analysing convergence in Canada, recall the theory of cumulative causation and agglomeration mechanisms for *growth poles* in this respect. Looking into even more detail, using ZIP code level data, a recent study by the Federal Reserve St. Louis examined whether the change since the beginning of the economic recovery in 2010 has been as positive as it seemed at the aggregate level and found substantial heterogeneity with mixed messages on the resiliency of many households to face another recession⁷. Experts from the IMF (2018) found an increasing degree of convergence among Euro area Member States, however according to their view; especially business cycle convergence did not improve with respect to the amplitude of cyclical developments (i.e. Euro area countries are in a similar state of the business cycle, but the rate of change differs substantially).

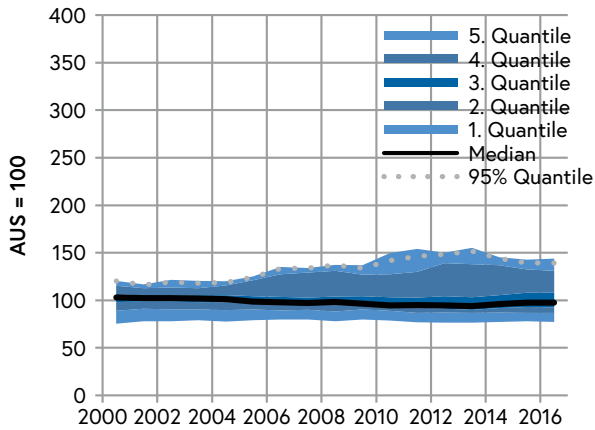
2.2 Some stylised facts

Recalling *hypothesis (1)*, we compare convergence of real GDP per capita in PPP of US federal states, Canadian provinces and Australian territories with that of Euro area Member States. For starters the following graphs compare relative income levels to the population weighted average GDP p.c. in PPP. The figures are interesting both when looking at dispersion of regional per capita income as well as different growth paths.

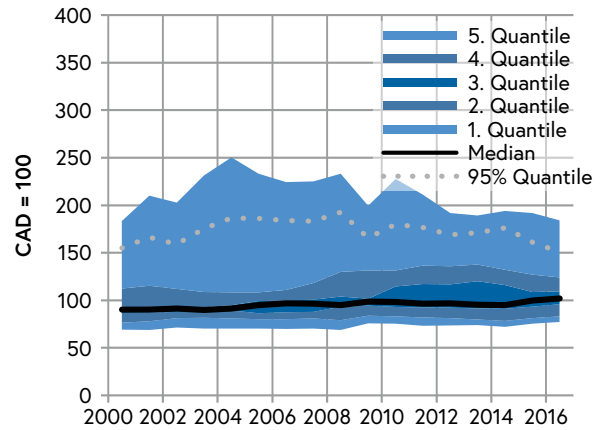
⁷ https://www.stlouisfed.org/publications/regional-economist/first-quarter-2019/unequal-recovery-measuring-financial-distress?utm_medium=email&utm_campaign=201905A%20Research%20Newsletter&utm_content=201905A%20Research%20Newsletter+CID_b62ae8271abe2d148172544082fa156d&utm_source=Research%20newsletter&utm_term=households%20in%20the%20poorest%20ZIP%20codes

Graph 4: real GDP p.c. in PPP dispersion

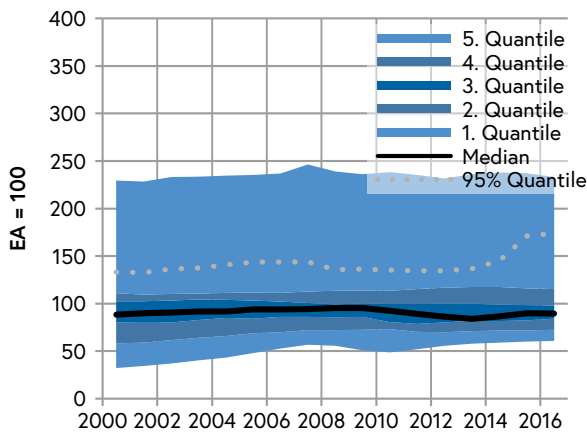
AUS territories



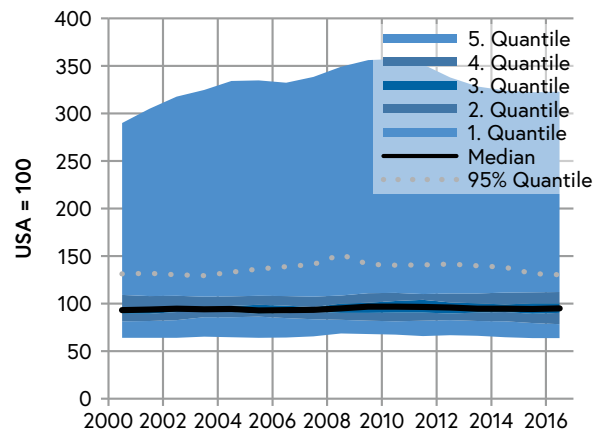
CAD provinces



EA Member states



USA states



Sources: OECD, own calculations

Braml and Felbermayr (2018) state in their paper that income disparities in federations *naturally* increase with population size, such that the distribution of income is by definition more unequal in countries with larger populations. This finding is not supported by our data, especially when looking at the 95th per cent quantile which minimises the effect of outliers (outliers on the lower bound of the bandwidth are relatively close to the five per cent quantile). The case is particularly unclear for instance in Canada, pointing at more complex causes for income inequality within federal states.

Relative income levels in Canada, the Euro area and the US moved fairly stable in parallel, which can be seen in the relatively narrow band between the second and fourth quantile

fourth quantile in the graphs above (the fifth quantile is artificially blurred by one top outlier province, territory and state in each block except for Australia). In the US the development shown in the graph basically resembles a sideways movement since the year 2000. In Canada the fourth quantile grew above average following the crisis, which hints at divergence during the later years of the period of observation. Even though Australia shows the smallest divergence in per capita income within this group of four peer blocks, the fourth quantile of GDP p.c. distribution grew above average almost over the entire period, also hinting at divergence of territorial income levels. In the US real per capita income increased significantly above average in states that developed shale gas and oil production as well as in the capital area (for instance North Dakota⁸, Washington D.C.). A similar development can be observed in Canada and Australia where the economy in the richest provinces and territories in per capita terms is also partly driven by commodities. In the Euro area disparities in real GDP per capita in PPP terms are decreasing, especially due to stronger growth in the formerly new Eastern European Member States such as Slovakia, Slovenia and the Baltics.

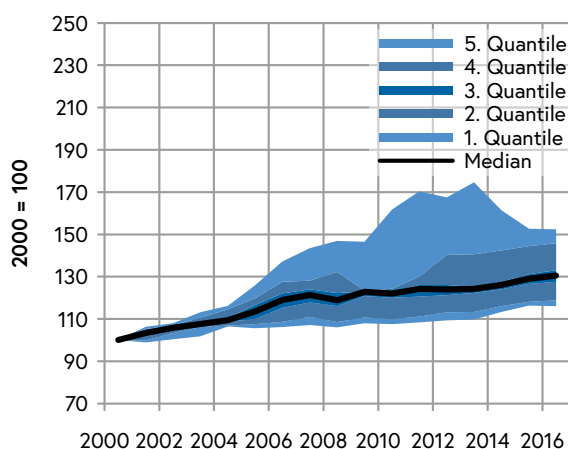
When looking at the different growth patterns of the aggregate federal level of the four peer blocks, it can be seen that all four countries recovered very differently to the two big shocks since the beginning of the new millennium. On aggregate the Euro area fared poorly both in the aftermath of the dotcom-bubble and especially since the beginning of the global financial and subsequent Euro area debt crisis as compared to the other countries (see *Figure 1* in the Annex). The question is whether this is related to the lack of a CFC and thus a lack of centralised spending or whether this development may be due to something else.

When again looking into more detail it can be seen that growth was also distributed quite unequally between the different states, territories and provinces within each respective block, which tells us that complete business cycle integration is not a common feature in country blocks with a significant central budget. Sub-federal levels in all four blocks experienced recessions of different intensities (depths and lengths) and forms (V- or W-shaped). Note that the analysis in this paper only focuses on the relative reaction and development of state level per capita income growth and not on the growth performance at aggregate level, which is a different story.

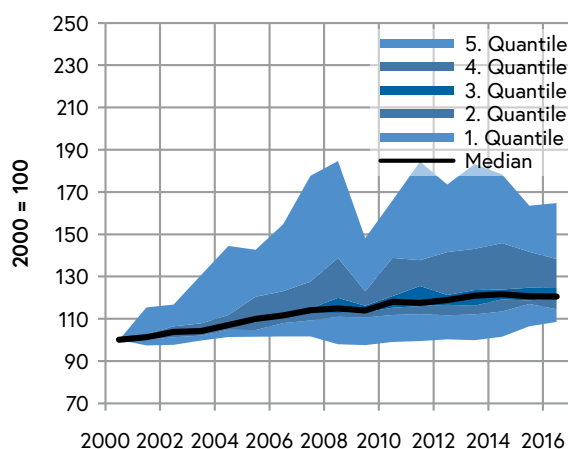
⁸ <https://www.eia.gov/state/analysis.php?sid=ND>

Graph 5: real GDP p.c. in PPP growth

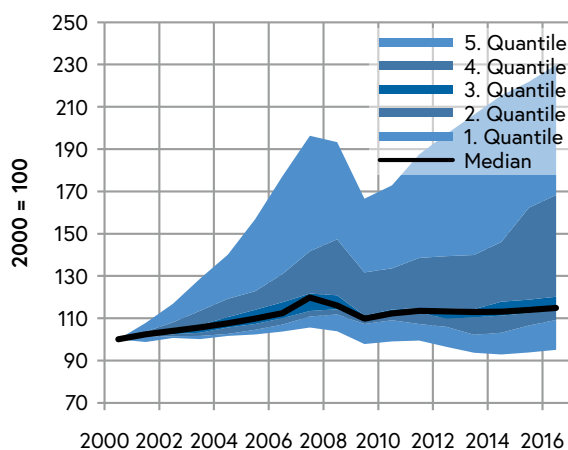
AUS territories



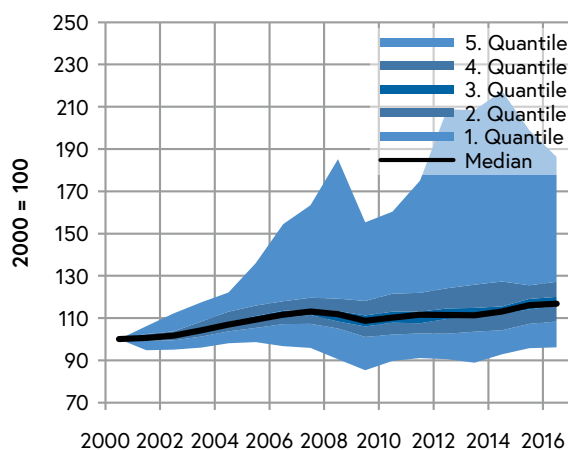
CAD provinces



EA Member states



USA states



Sources: OECD, own calculations

Now in order to look into the data more analytically, we utilise a simple model to determine whether patterns of *Beta*(β)- or *Sigma*(σ)-convergence are present. We therefore estimate four sets of income data from the OECD for all provinces, territories and states within the four peer blocks starting in 2000 until 2016. For the Euro area, we also take an additional even deeper look into detail at the regional level in a separate exercise. All point estimates and 95 % intervals can be found in the Annex in Figure 3.

To formalise our analysis of income disparities further, we derive the Theil-indicator, which gives us the opportunity to decompose developments of inequality in *laggard* and *above-average-performing* regions.

Lastly, we approximate resilience to economic shocks for each state, province or territory via two simple yet informative measures for (i) output loss and (ii) recovery time, both following the dotcom bubble after 2000 as well as after the GFC starting in 2008.

2.3 Convergence

Baumol (1986) defines two standard indicators for economic convergence, both consistent with neoclassical growth theory⁹.

2.3.1 β -convergence

β -convergence follows the standard neoclassical assumption that poor regions display more dynamic growth, due to higher marginal returns on capital, than richer regions. Therefore regions in total should converge. β -convergence in this context is measured by the correlation coefficient of the deviation of the mean growth rate of a region over a given period and the deviation of its initial level to the mean level.

$$\ln\left(\frac{PPPpc_{i,t}}{PPPpc_{(i,t-1)}}\right) - \emptyset(growth) = \alpha + \beta \ln\left(\frac{PPPpc_{i,t-1}}{\emptyset(PPPpc_{t-1})}\right) + \varepsilon_{it} \quad (1)$$

where $PPPpc$ are Purchasing Power Parities in per capita terms, \emptyset indicates that the population weighted mean is calculated, $\emptyset(growth)$ is the average growth rate over the whole region, ε is the error term and β is the correlation coefficient. In this setup $\beta < 0$ implies convergence.

2.3.2 σ -convergence

σ -convergence is simply the Coefficient of Variation of a dataset. It shows the level dispersion over a region in a given year. This makes it useful for comparisons over time.

$$CoV = \frac{sd(PPPpc_t)}{\emptyset(PPPpc_t)} \quad (2)$$

where sd is the standard deviation.

⁹ I.e. capital accumulation depends on returns, which are decreasing in the margin, and capital can move unhindered.

Young et al (2008) show with simple algebra that the concept of β -convergence is a necessary, but not sufficient condition for long term income (i.e. σ -)convergence.

The data contains information from 2000 to 2016 for logged per capita (pc) PPP for state and sub-state level (TL 2 regions in the Euro area¹⁰). For β -convergence figures, the data on the y-axis is the deviation from the mean growth rate of PPP_{pc} during the indicated time frame. The data on the x-axis is the deviation from the level of PPP_{pc} since the earliest year in the dataset (i.e. 2000-2007, 2008-2016 and 2000-2016). The lower left and upper right quadrants of the figures show regions that drive tendencies of divergence, while the upper left and lower right show convergence. The graphs together with tables in the Annex display a regression line, the according regression coefficient and p-value. In general, a downward sloping regression line indicates β -convergence, as initially poorer Member States grow at an above average pace. The p-values show whether this relationship is statistically significant or not.

2.4 Inequality

Another aspect in the context of income distribution is inequality. Are disparity and inequality two sides of the same coin? Intuitively one may think that decreasing dispersion of income levels coincides with lower inequality. Theoretically this is, however, neither necessary nor sufficient (amongst others due to outliers). Therefore, dispersion as described under section 2.2 above does not provide us with the full picture, for which we now turn to other descriptive tools. Complementary to **Graph 4** on income dispersion we provide additional information about the distribution of average income levels and growth grouped by relative income levels in the following sub-sections. The terms post dotcom and post GFC refer to the end of the cycle of the two periods, approximated with the end dates 2007 and 2016 of the two sub-periods observed in this analysis.

Haughton and *Khandker* (2009) discuss different criteria and options to measure inequality in more detail, such as the **Gini-**, **Atkinson-** or **Theil-index**. We apply the latter one for our purposes.

¹⁰ "The differences with the Eurostat NUTS classification concern Belgium, Greece and the Netherlands where the NUTS 2 level correspond to the OECD TL3 and Germany where the NUTS1 corresponds to the OECD TL2 and the OECD TL3 corresponds to 97 spatial planning regions (Groups of Kreise). For the United Kingdom the Eurostat NUTS1 corresponds to the OECD TL2." Stats.OECD.org

2.4.1 Theil-index

The *Theil*-index is a widely used indicator for inequality, belonging to the family of so called *generalized entropy (GE)* measures. One key aspect is that, for instance other than the more widely known *Gini*-index, it allows for decomposition by population groups and other dimensions.

$$T_{index} = \frac{1}{N} \sum_{i=1}^N \frac{PPP_i}{PPP} \ln \left(\frac{\left(\frac{PPP_i}{PPP} \right)}{\left(\frac{Pop_i}{Pop} \right)} \right) \quad (3)$$

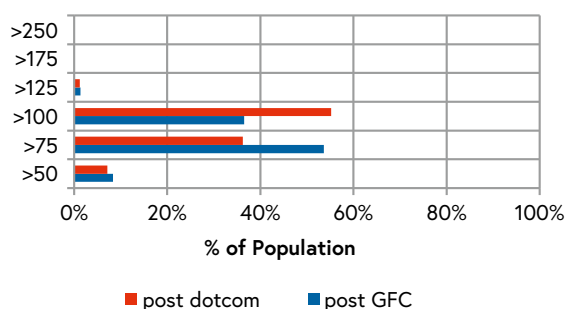
The basic idea is that the closer individual observations are to the mean, the smaller the index as the last term in logarithm approaches zero. A *Theil*-index of zero would indicate perfect equality.

2.5 The case of the Euro area

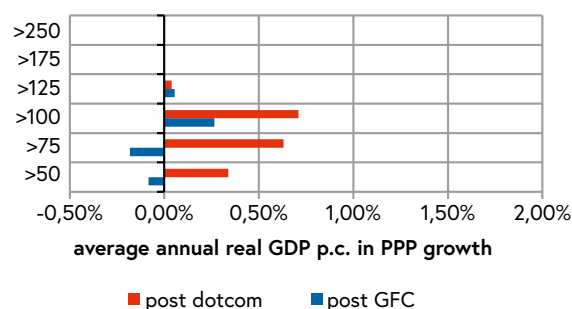
As outlined in section 2.2 absolute differences in income levels are large in the Euro area, however, mostly due to two outliers (Ireland and Luxembourg) that represent only a small fraction of the overall Euro area economy and population. The bulk of Member States accounting for roughly 90 % of the Euro area population had income levels between 75-125 per cent of the Euro area average. The composition within this block shifted following the GFC, which can be seen in the graph below. The second part of the graph approximates Member States contributions to total Euro area growth. In both periods growth was strongest in Member States within the 100-125 per cent bracket, whereas especially following the GFC the contributions of Member States in the 50-75 and 75-100 per cent brackets were negative.

Graph 6: income and growth distribution grouped by relative income levels

EA-Member states - income distribution



EA-Member states - growth distribution

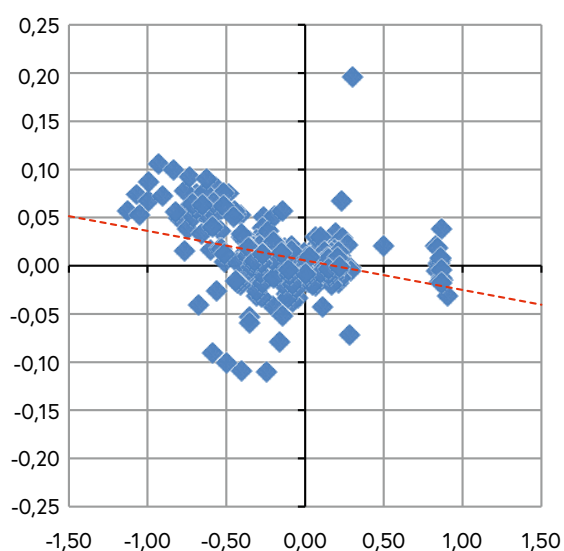


Sources: OECD, own calculations

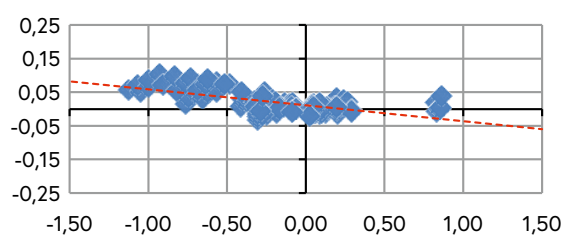
In general, β -convergence is significant in the Euro area from 2000 – 2016 as well as before the GFC, regardless of the TL-level, at the 95 % level. On state level, most Member States support the convergence hypothesis. Some grew slower as expected given their low initial PPP p.c. income level (i.e. Slovenia, Spain, Portugal and Greece) and one Member State grew much faster than expected (i.e. Ireland¹¹). The estimator for β -convergence was not significant in the period following the GFC.

Graph 7: β -convergence

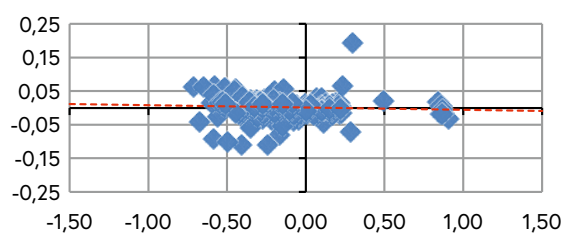
EA - 2000-2016



EA - 2000-2007



EA - 2008-2016



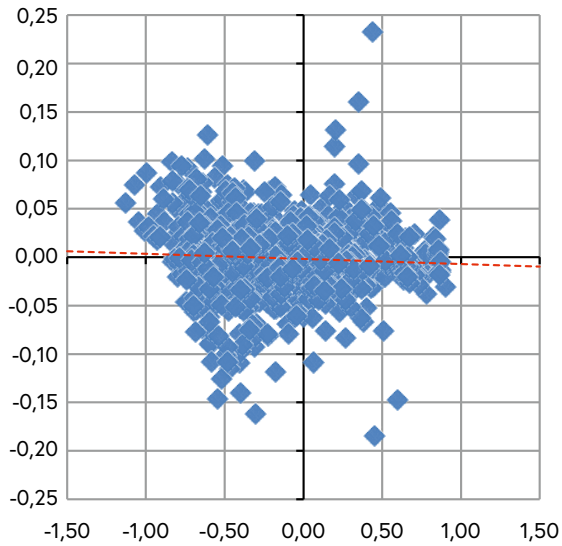
Sources: OECD, own calculations

On a sub-state (TL 2) level, findings for before the GFC and the full period are confirmed. However, after the GFC the regression line slope turns positive and remains statistically significant, hinting towards divergence.

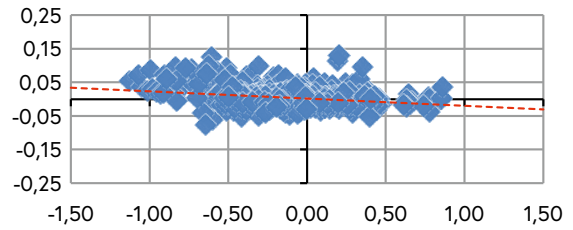
¹¹ Note that Ireland is a special case, since national accounts are difficult to compare to other Member States, due to developments after the crisis. This is somewhat confirmed by the fact that before the GFC Ireland was not an outlier.

Graph 8: β -convergence

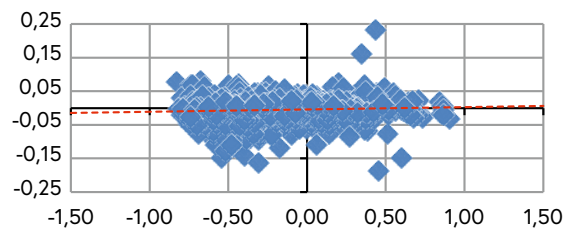
EA TL 2 - 2000-2016



EA TL 2 - 2000-2007



EA TL 2 - 2008-2016



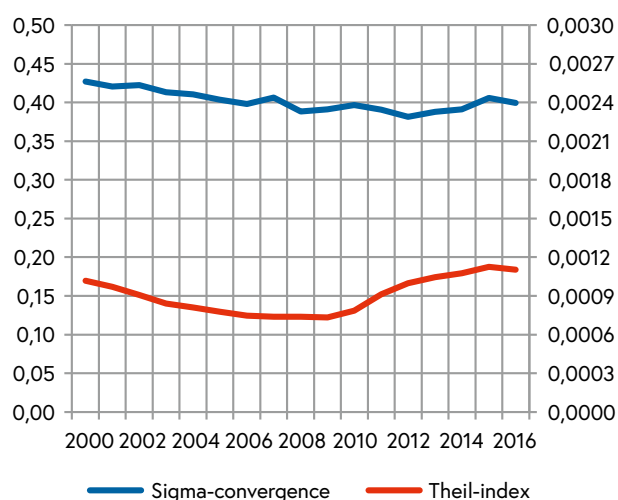
Sources: OECD, own calculations

σ -convergence on a Member State level can be observed until 2012, as the Coefficient of Variation decreases more or less steadily. In 2009 it increases, but only temporarily and also only slightly. From 2012 onwards it increases again but only relatively weak.

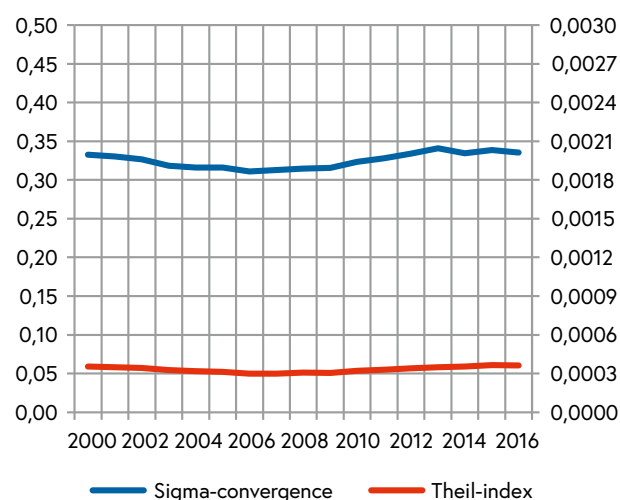
Switching to the sub-state (TL 2) level, we see similar developments, however, in a narrower band. σ -convergence for the regions weakened slightly after the GFC, resulting in a Coefficient of Variation at a similar level than before the introduction of the Euro.

Graph 9: σ -convergence and inequality – 2000-2016

EA Member state level



EA sub-state (TL 2) level



Sources: OECD, own calculations

Inequality of income was also decreasing until 2008 and 2009 on a Member State level. Interestingly, income levels were more equal and its distribution more stable on a substate (TL 2) level, which was close to zero and showed a basically flat sideways movement.

In general, we conclude that for the Euro area as a whole convergence has weakened in the post-GFC period. NUTS 2 regions, which are very similar to TL 2 regions in the Euro area, are targeted by cohesion policy, which seems justified by these findings, since convergence patterns are weaker. Whereas structural reforms and investment on a national level are paramount, focus on cohesion policy and reasons for divergence appear to work on a sub-national level. This hypothesis motivates a closer look into some Euro area Member States (see next Chapter).

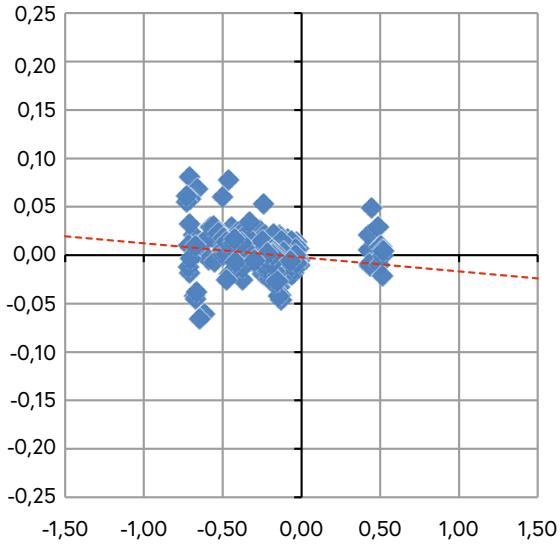
2.5.1 convergence within Euro area Member states

In order to gain further insight into convergence patterns within Euro area Member States, we chose the four biggest Members of the Euro area, namely Germany, France, Italy and Spain, that account for roughly three quarters of Euro area output for closer assessment.

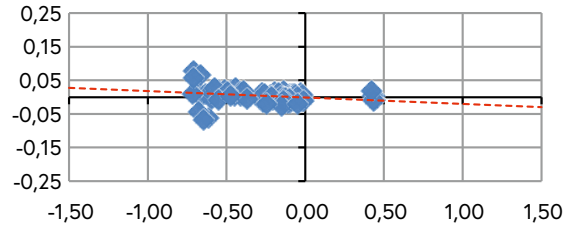
Starting with Germany and France, we observe that during the entire period as well as in the split view before the GFC regions converged significantly. Other than in Germany, French regions did not converge further following the GFC, where the slope became basically flat and the estimator is no longer significant.

Graph 10: β -convergence on sub-state (TL 2) level

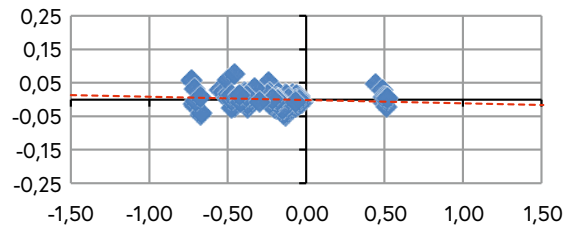
FR - 2000-2016



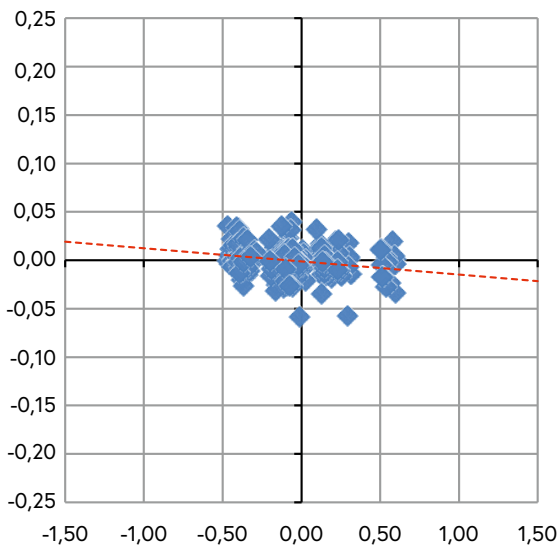
FR - 2000-2007



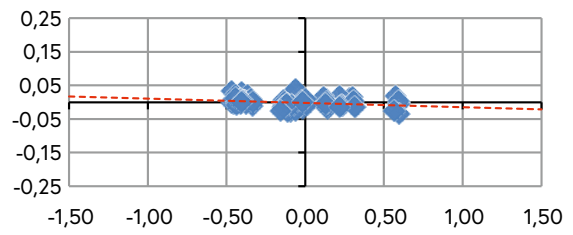
FR - 2008-2016



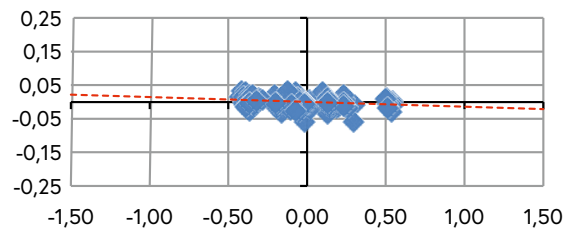
DE - 2000-2016



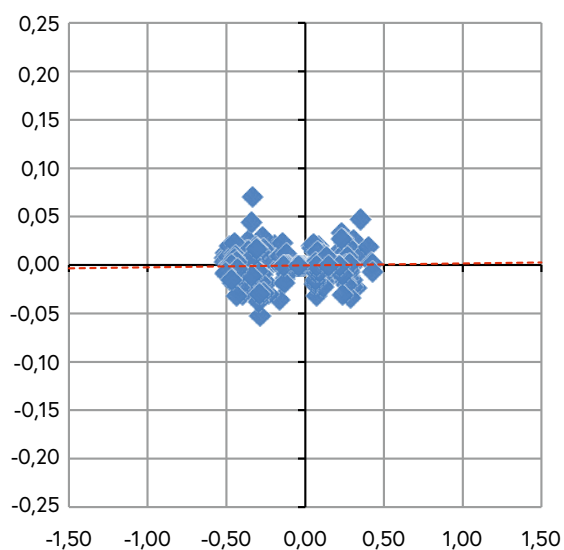
DE - 2000-2007



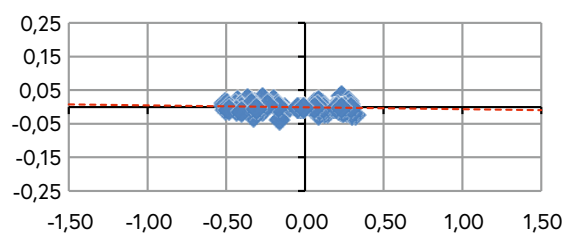
DE - 2008-2016



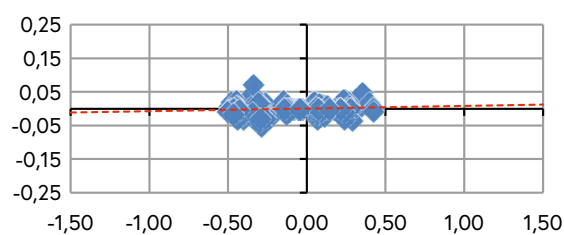
IT - 2000-2016



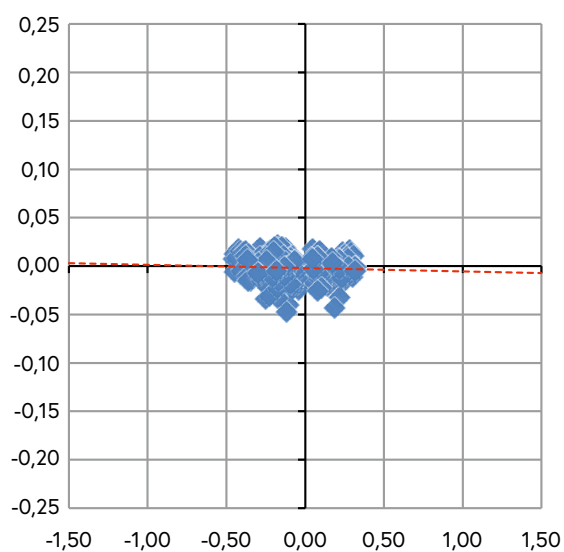
IT - 2000-2007



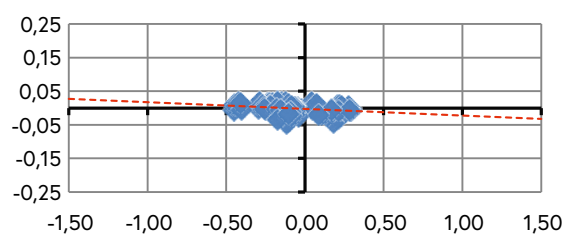
IT - 2008-2016



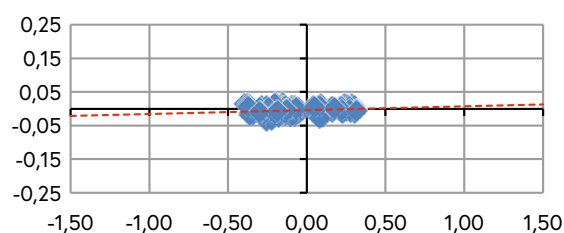
ES - 2000-2016



ES - 2000-2007



ES - 2008-2016



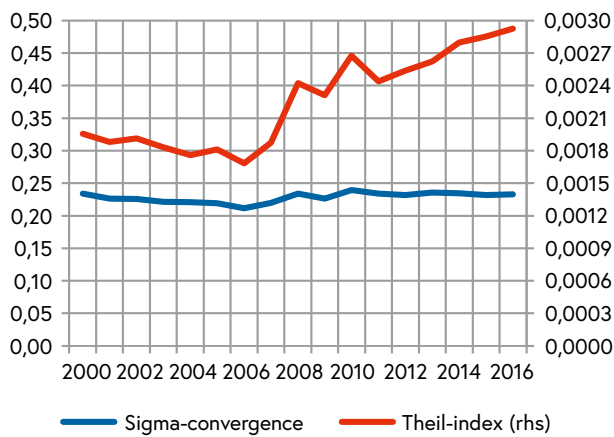
Sources: OECD, own calculations

Italy is a very different story when compared to Germany and France. Since the introduction of the Euro there was no significant convergence between the regions within this Member State. Even when restricting the sample to pre-GFC periods the slope is negative, but statistically insignificant. After the GFC the slope becomes positive and stays insignificant. We therefore conclude that there has been no real change when it comes to convergence of sub-state (TL 2) regions in Italy.

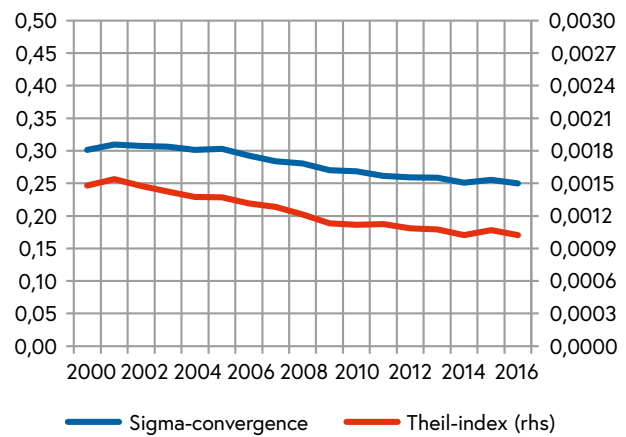
Spain finally is yet another story. Throughout the entire time span Spain did not experience significant convergence of its sub-state (TL 2) regions. However, before the GFC there was strong and significant convergence. After the GFC this trend reversed almost completely.

Graph 11: σ -convergence and Theil-index

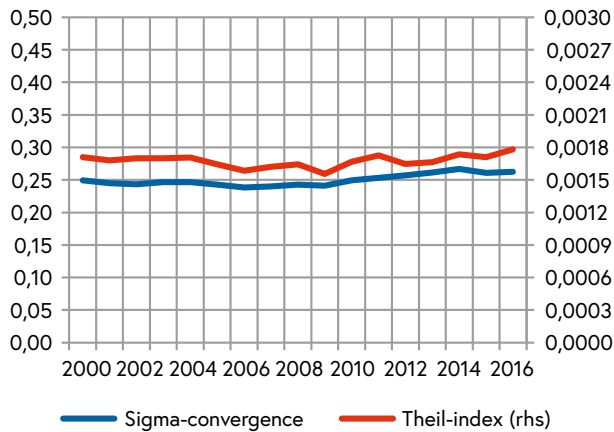
France



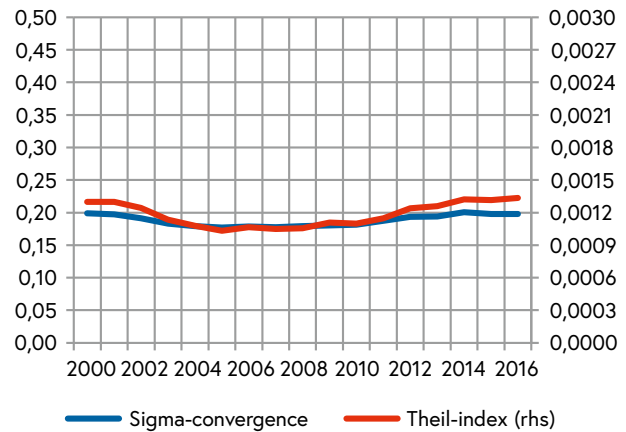
Germany



Italy



Spain



Sources: OECD, own calculations

σ -convergence was mostly unchanged for France, Italy and Spain and slightly improving in Germany over the entire time-span.

While inequality remained fairly unchanged in Italy and Spain, it decreased considerably in Germany and increased substantially in France.

In conclusion, convergence within the major economies of the Euro area is very heterogeneous. Where in some Member States there has been successful convergence of regions, in others the trends seem to point into different directions. Some poorer regions seem to be hit harder by the consequences of the GFC than richer ones.

2.6 The case of the peer federal states

In order to analyse convergence and resilience patterns in the United States, Australia and Canada, we again refer to OECD data for real GDP p.c. in PPP. Sub-regional data was not available for the peer countries; therefore there is no special focus on potential convergence patterns within the states, territories and provinces as for the Euro area.

2.6.1 From an Australian perspective

Australia is a special case in point. It holds the world record of the longest period without experiencing a (technical) recession¹². It outpaced its peers in all categories analysed for this paper since 2000¹³. Most interestingly, even though Australia had the strongest population growth according to OECD data, it also experienced the highest GDP p.c. growth. Accordingly, a large share of its Gross Fixed Capital Formation came from construction of dwellings.

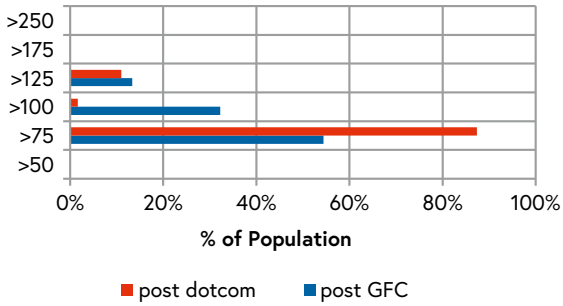
What can be observed is that, for instance in Australia, p.c. incomes in the 75-100 per cent bracket (relative to Australian average = 100) outperformed all other income brackets with an 1.5 per cent annual average growth rate until 2007, whereas incomes in the 100-125 bracket grew strongest around 0.6 per cent during the period until 2016; again hinting at divergence.

¹² <https://www.nber.org/cycles.html>: NBER does not define a recession in terms of two consecutive quarters of decline in real GDP. Rather, a recession is a significant decline in economic activity spread across the economy, lasting more than a few months, normally visible in real GDP, real income, employment, industrial production, and wholesale-retail sales.

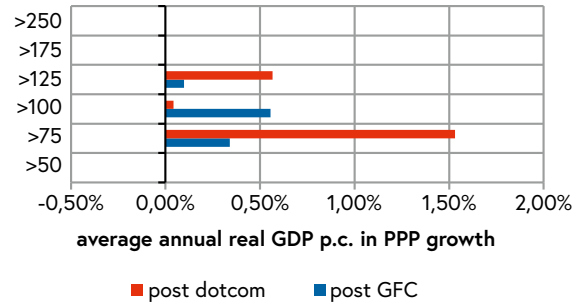
¹³ <https://www.ft.com/content/024c4f8c-8763-11e9-a028-86cea8523dc2>

Graph 12: income and growth distribution grouped by relative income levels

AUS-territories - income distribution



AUS-territories - growth distribution

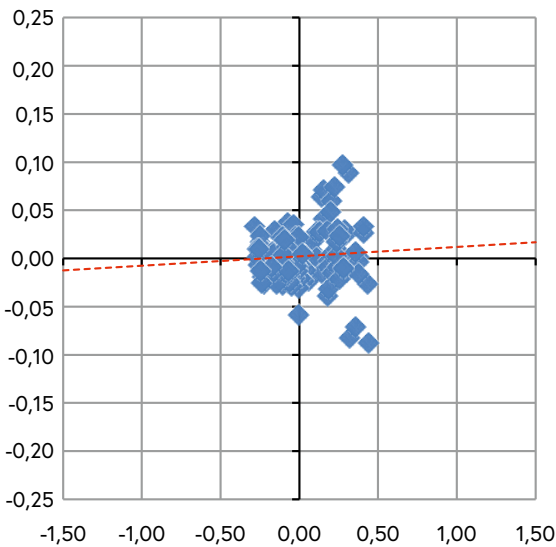


Sources: OECD, own calculations

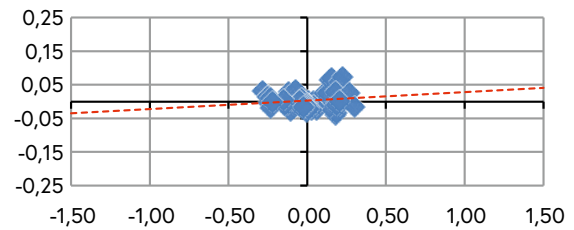
In terms of real GDP p.c. Australia has the lowest dispersion among the four peers. Nonetheless, this seemingly even distribution of income does not prevent divergence both throughout the entire period of observation as well as in the split view before and after the crisis, where the coefficient is positive but not significant at a 95 % level.

Graph 13: β -convergence

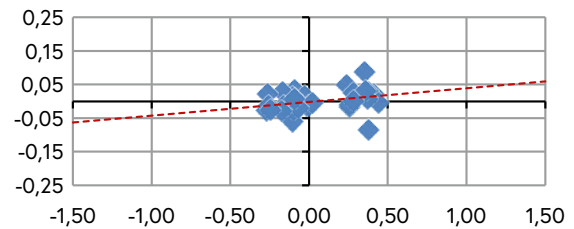
AUS - 2000-2016



AUS - 2000-2007



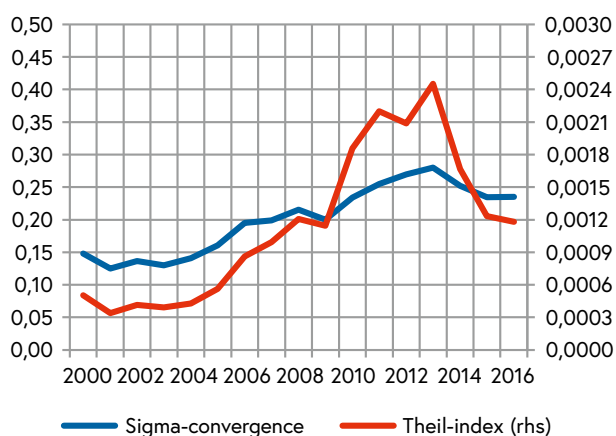
AUS - 2008-2016



Sources: OECD, own calculations

There is also clear evidence for growing dispersion in terms of σ -convergence, where the coefficient of variation is on a clear upwards trend throughout the entire period. Inequality of income was increasing heavily until 2013, after which the index value dropped by half to still comparatively high levels.

Graph 14: σ -convergence and Theil-index – 2000 - 2016



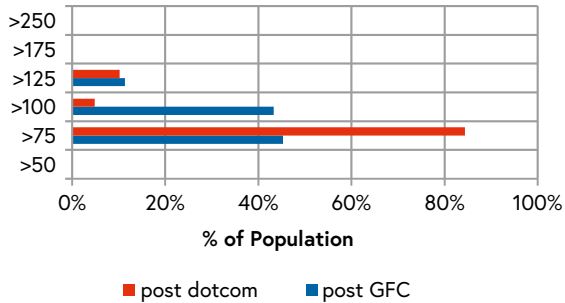
Sources: OECD, own calculations

2.6.2 From a Canadian perspective

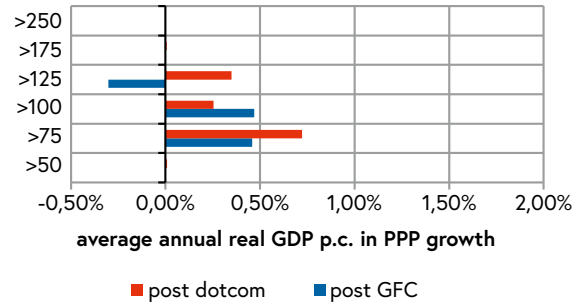
Some Canadian provinces have benefitted strongly from the boom in demand for its natural resources, which could be seen in soaring growth rates in some provinces especially before the GFC. As described already under *section 2.2*, Canadian provinces with incomes in the 125-175 per cent bracket incurred income losses following 2008, though its overall share remained fairly stable. Incomes in the 75-100 and 100-125 per cent brackets each contributed slightly below 0.5 per cent annually to national growth.

Graph 15: income and growth distribution grouped by relative income levels

CAD-provinces - income distribution



CAD-provinces - growth distribution

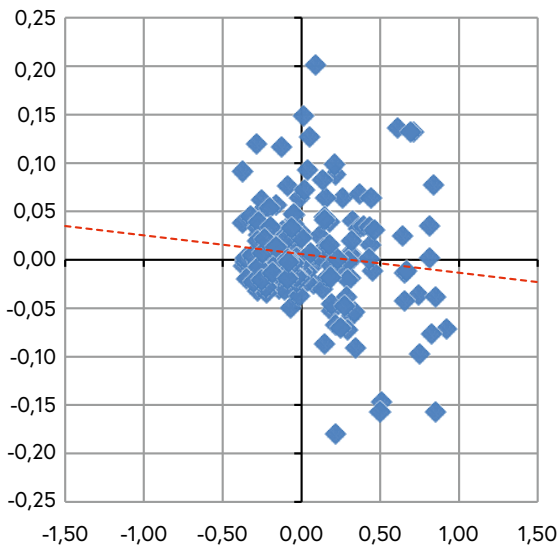


Sources: OECD, own calculations

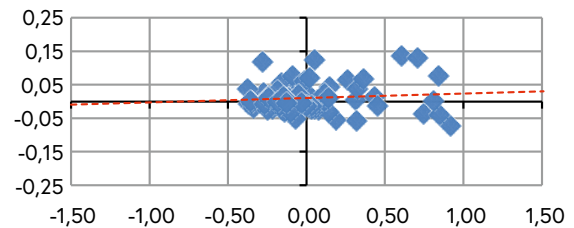
There was no significant trend for β -convergence between 2000 and 2016. When splitting the data pool, however, it can be seen that convergence occurred after the crisis, where the estimator is clearly negative and significant. This can be explained through a stronger decrease of income levels of provinces performing well before the GFC, as well as through a more meagre catching up process of lower income regions. β -convergence was basically flat and insignificant before the crisis.

Graph 16: β -convergence

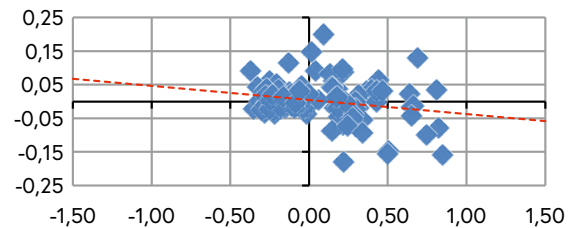
CAD - 2000-2016



CAD - 2000-2007



CAD - 2008-2016



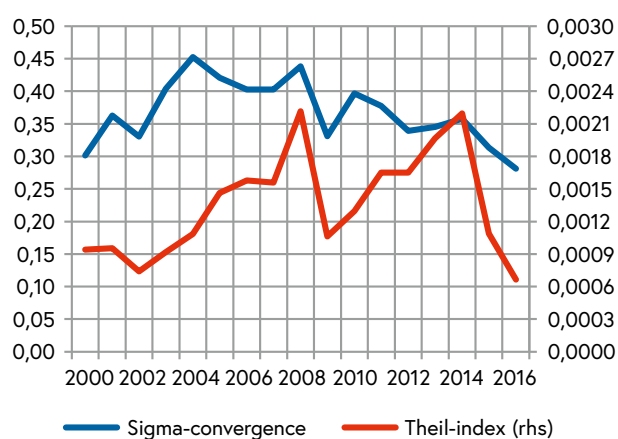
Sources: OECD, own calculations

The same picture occurs in terms of σ -convergence, where dispersion was volatile until 2008 and changed to a declining trend afterwards.

Inequality of incomes was volatile as well; before returning to lower levels towards the end of the observed period.

Graph 17 σ -convergence and Theil-index – 2000 - 2016

Canada



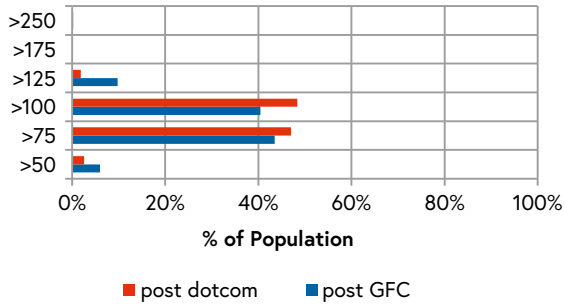
Sources: OECD, own calculations

2.6.3 From a US perspective

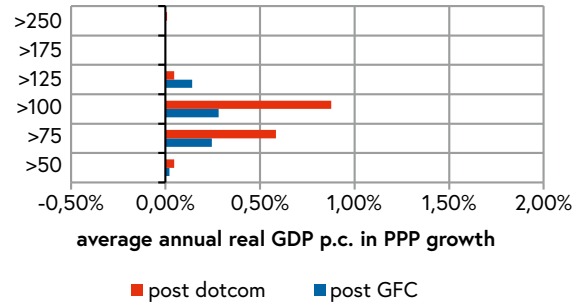
The shares of relative income levels were similar in the US and the Euro area prior to the GFC, more or less equally distributed in the 75-100 and 100-125 per cent brackets. These shares decreased significantly by roughly 10 percentage points which were shifted mostly to the 125-175 but also to some part to the 50-75 per cent brackets. So both richer as well as poorer regions had their shares growing at the expense of the *mid income states*.

Graph 18: income and growth distribution grouped by relative income levels

USA-states - income distribution



USA-states - growth distribution



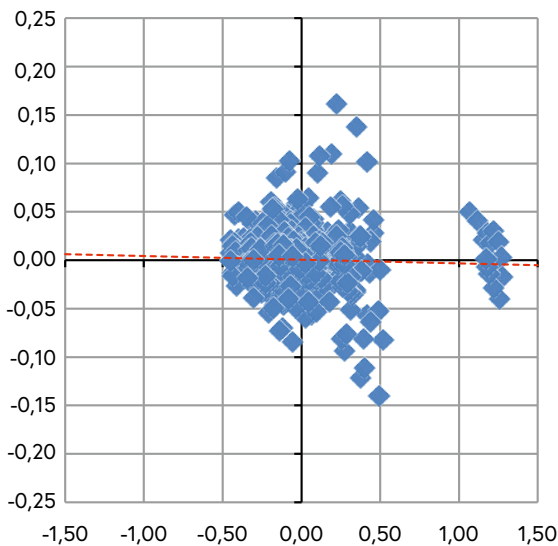
Sources: OECD, own calculations

Looking at the period from 2000 to 2016 the US federal states did not experience β -convergence, where the estimator is slightly negative, though insignificant.

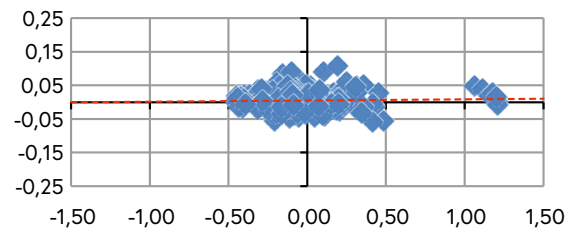
When looking at the temporal split, the estimator is insignificant before and after the crisis. During the post dotcom/pre-GFC period, the coefficient was even slightly positive.

Graph 19: β -convergence

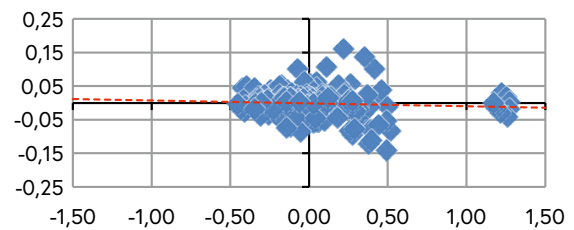
USA - 2000-2016



USA - 2000-2007



USA - 2008-2016



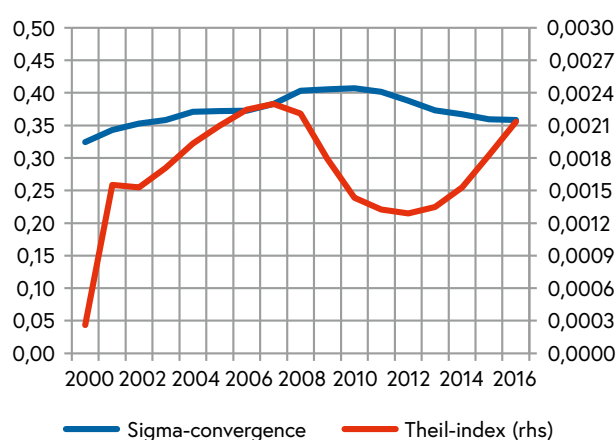
Sources: OECD, own calculations

There was no σ -convergence until the GFC, where the disparity increased, but afterwards starting in 2011.

Interestingly, inequality of state output was increasing strongly before the crisis, after which the distribution became more even for a short period of time, after which it turned and became more unequal again towards the end of the observations again.

Graph 20: σ -convergence – 2000 - 2016

United States



Sources: OECD, own calculations

2.7 Resilience

Recalling **hypothesis (2)**, we developed two fairly simple and easily understandable indicators to measure the ability to resist a shock (*instantaneous resilience*) on the one hand and to recover (*dynamic resilience*) on the other hand. We again split the sample into two periods, one following the burst of the dotcom bubble in 2000 and one following the *annus horribilis* of 2008 in which basically the entire world economy stumbled.

Regarding the ability to withstand shocks and limit output loss, we measure the relative size of loss of real GDP p.c. in PPP from peak to bottom in per cent of change.

Regarding the ability to recover, the indicator is constructed such that it adds up population weighted years for each sub-federal economy; i.e. if Germany accounts for roughly 25 % of the entire Euro area population and Germany recovered within three years, it follows that 25 % of the Euro area had recovered within three years and so forth. The individual weights are then accumulated according to time to recovery.

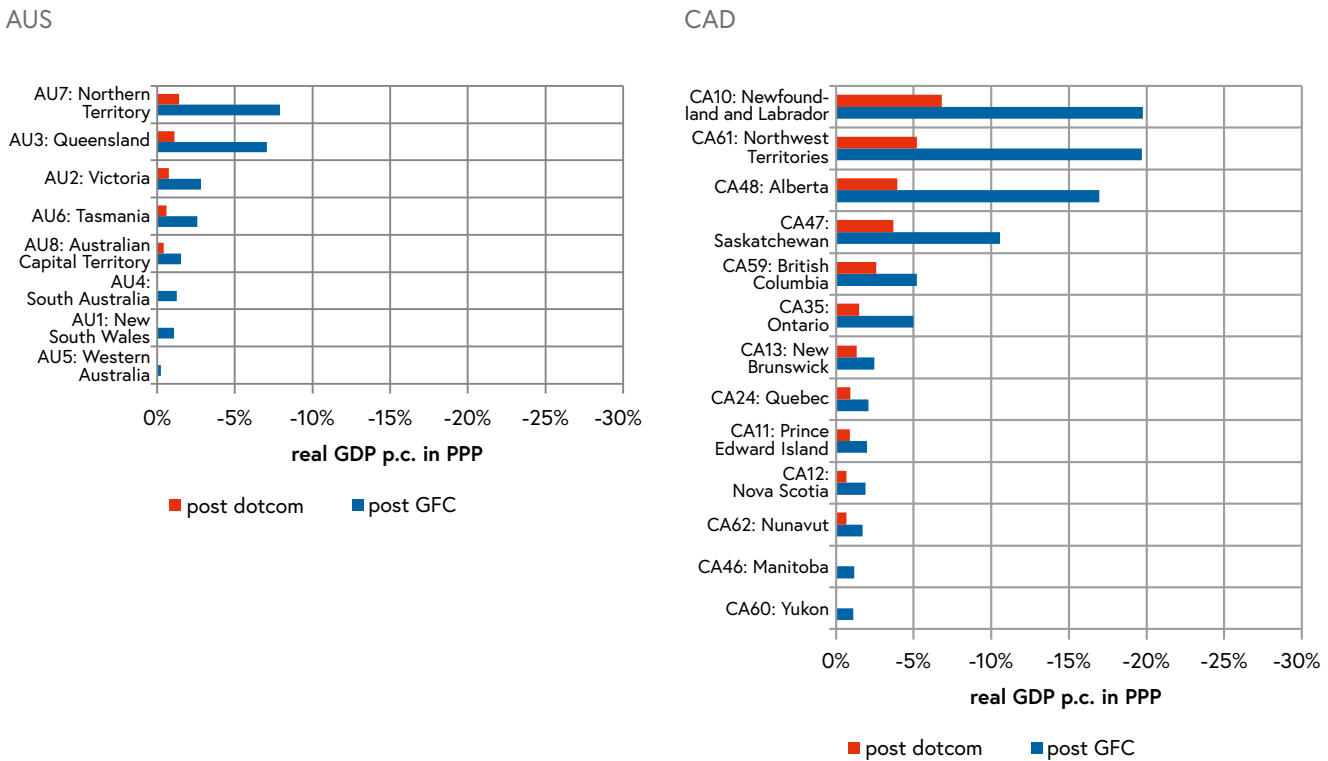
2.7.1 Instantaneous resilience

While the economic contraction following the *dotcom* bubble was rather severe in some US states and Canadian provinces, most Euro area Member States and Australian territories did not incur income losses or only underwent mild recessions (we do not use the common definition of a recession in our analysis – see footnote 12 – as we only consider the more limited index for – negative – real GDP p.c. in PPP growth).

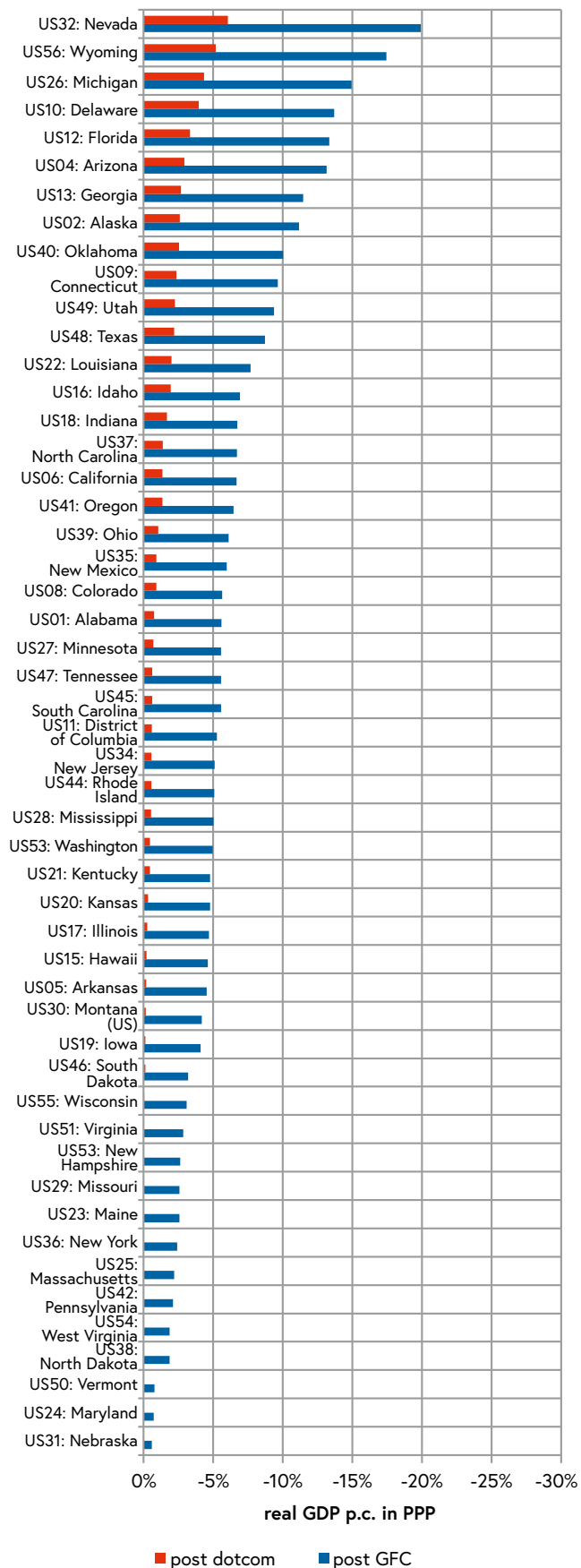
During the post GFC period starting in 2008 after the Lehman collapse, territorial and provincial economies in Australia and Canada suffered substantially though significantly less than the Euro area countries and US states. Immediately following the GFC, or rather as a regional extension of it, the Euro area Member States were faced with a subsequent crisis of its own, the so called *Euro area (sovereign) debt crisis* starting in 2010 during which many Euro area countries incurred a second round of significant income losses.

Note that aggregate real GDP p.c. in PPP of the federal economy of the four peer countries was recovering quicker than the accumulated (population) weighted sub-federal levels, as there are counterbalancing effects in place, if some regions incur lower output losses or recover quicker.

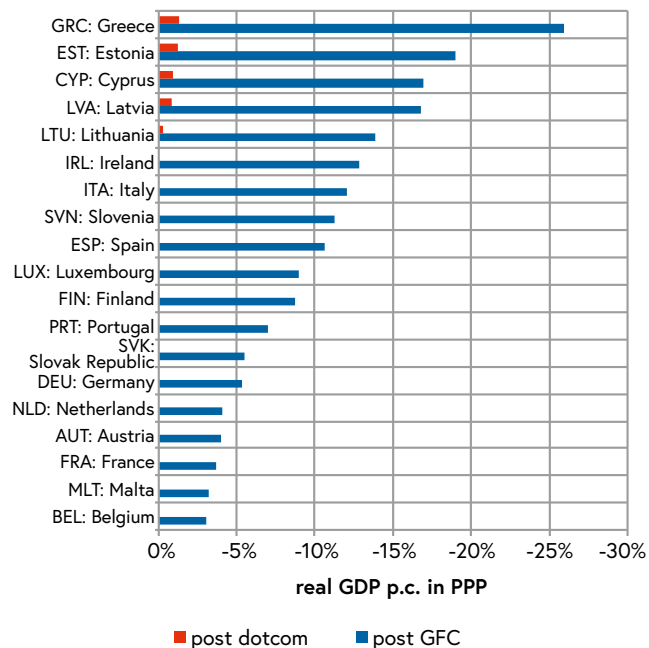
Graph 21: output loss peak/bottom



USA



EA



Sources: OECD, own calculations

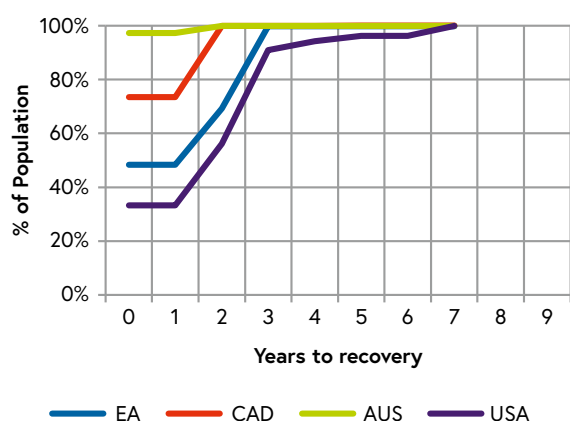
2.7.2 Dynamic resilience

Looking at the time to recovery following the burst of the dotcom bubble, it took the Euro area Member States some time to regain its pre-dotcom income level as two large and one medium sized Member State had incurred output losses in GDP p.c. in PPP terms (namely Germany, Italy and the Netherlands), even though absolute income losses as such were rather limited. The US as the epicentre of this crisis took the longest to recover income levels in all its federal states. Canada who was also hit hard during the dotcom recession had already recovered within two years following the downturn.

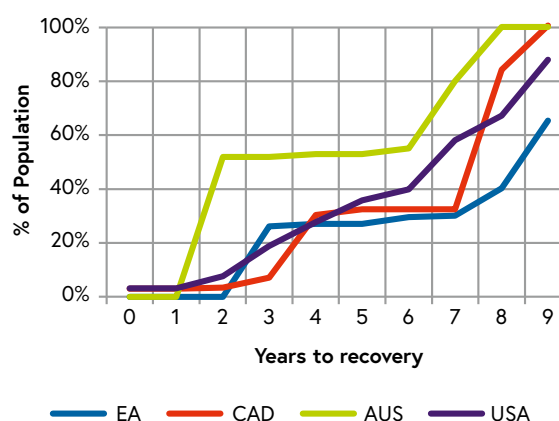
Looking at the post-GFC period, the weighted number of years to recovery for US states was spread more steadily as for the other countries. However, not all US states managed to recover its pre-crisis p.c. income levels, which can be seen from the graph. Australia recovered relatively quicker than its peers. Income losses were severe in some Canadian provinces and it took provincial economies eight to nine years to fully recover.

Graph 22: Years to recovery on provincial/territorial/state level

post dotcom



post GFC



Sources: OECD, own calculations

Turning to the Euro area, only two Member States (Germany and Slovakia) reached their pre-GFC income levels again in the third year following the downturn, while the majority of countries – among them the economically important Members France and the Netherlands – took significantly longer between seven to nine years. Some Member States did not fully recover at all during the period until 2016 (Spain and Italy).

A similar picture as for convergence developments can be observed within the Euro area regarding dynamic resilience. While only three out of 16 German regions took longer than two to three years to recover from the GFC, only one out of 21 Italian regions for which

data was available recovered within four years, whereas all others took nine years or did not fully recover at all during the period under observation. The aggregate Italian real p.c. income in PPP is currently more than 10 per cent below its pre-GFC level. Also Spain, which was the only major economy in the Euro area requesting an ESM programme at the time, could not fully regain its pre-GFC per capita income levels during the observed period. France on the other hand took nine years to recover after the GFC, whereas the overall size of income losses was among the lowest in the Euro area.

A development akin to that of Euro area Member States can be seen when looking at resilience of individual US states, where even the largest state economy of California took seven years to restore real p.c. income levels to pre-GFC levels. New York and Texas ranking number two and three among the economically largest US states took three and four years respectively to regain its prior real GDP p.c. levels. As in the Euro area several states took eight to nine years to recover fully, if ever.

In Canada, six out of thirteen regions for which data is available fared pretty well and recovered within only a few years. Where in principle the relatively richer provinces fared better than the remaining ones, two wealthier provinces whose regional economy has a strong dependence on the oil and gas industry only performed badly following the GFC.

Finally in Australia, five out of eight territories for which data is available recovered very fast within one to two years. One territory did not suffer any income losses at all immediately after the GFC; however, it did so heavily between 2013 and 2016, which again may to some part be due to lower revenues from commodities.

Chapter 3: Conclusion

In this paper we look at convergence and recovery patterns of states, provinces and territories in the Euro area, the United States, Canada and Australia. While the latter three are genuine federal countries, the Euro area is at its current juncture a country block within the comparatively lesser integrated federation of the European Union. Looking at the data, we find that a comprehensive story of economic convergence cannot be told by comparing individual Euro area Member States with its peers. Instead one has to compare the aggregate Euro area to the other countries to draw a more accurate picture. In order to make the four blocks comparable, we undertake a small thought experiment, in which the Euro area becomes a hypothetical political union with a central budget.

Some stylised facts hint to the assumption that a lack of revenue may not be the core problem when assessing real GDP p.c. convergence and economic resilience in the Euro area, but rather a question of political preferences concerning expenditure structures and the reallocation of public funds as well as of the structure of the economy as a whole. Other structural factors such as regulation, education, business environment, etc., or more temporary issues such as commodity driven growth are not looked at in detail but may well have a key impact. As a reminder, we focus on real GDP p.c. in PPP in our analysis.

Secondly, we find that the issue of convergence or divergence cannot be detected properly when looking only at a state, provincial, or territorial level but rather at (sub-) regional levels such as TL 2, which we did for the Euro area and which is also supported by findings of the Federal Reserve St. Louis. Analysing more granular data provides us with a more meaningful insight into current developments within the four biggest Euro area Member States.

Furthermore, we see varying degrees of convergence within all four country blocks over time. We find no evidence that states, territories or provinces as a matter of principle converge faster, have more equal income levels, or recover swifter from shocks than Euro area Member States that have no large scale CFC. Convergence is therefore, no steady path and states keep changing their relative position in the income ranking over time. Though we find some hints in the data that economically wealthier states, regions or provinces overall fare better than poorer ones, hinting at benefits of concentration and agglomeration.

Finally and to some degree surprisingly, we find that convergence and resilience do not necessarily go hand in hand. The most resilient country block under review is at the same time the country in which regional income levels do not con- but diverge, namely

Australia. It is also interesting that dynamic and instantaneous resilience do not necessarily coincide, i.e. some states, territories or provinces lost only a small fraction of its output but took long to recover and vice versa.

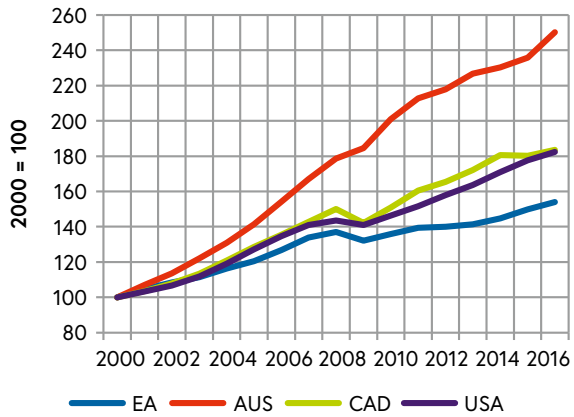
The current discussion on a possible Euro area BICC falls considerably short of thoroughly analysing the core mechanics both for economic divergence as well as poor economic resilience to shocks. As convergence within unions is not fostered by a sizeable central budget, a BICC as currently discussed will not yield the targeted results. There may be a case for a stabilisation function for the Euro area; however, we are hesitant to jump to further conclusions without better understanding of the observed dynamics. If a stabilisation function for the Euro area would be designed in a way as proposed by the international institutions – as outlined in the introduction – such a function would basically provide (cheap and reliable) credit to Euro area Member States and thereby basically replace market financing, an issue already addressed by the European Stability Mechanism and thus not completely new.

Further research is certainly warranted to better understand the reasons behind the developments identified, such as on the stock and quality of capital and labour, labour market dynamics, trade and financial integration within and outside its union.

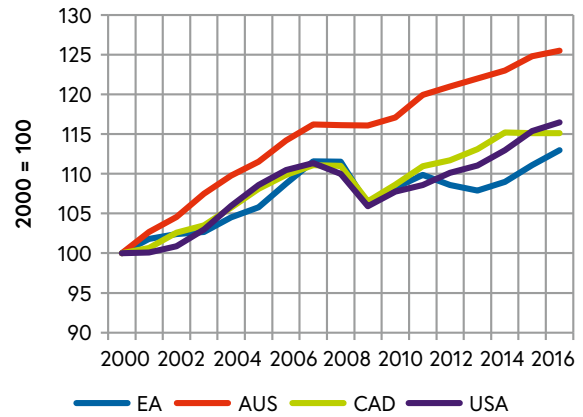
Annex

Figure 1: GDP and population growth

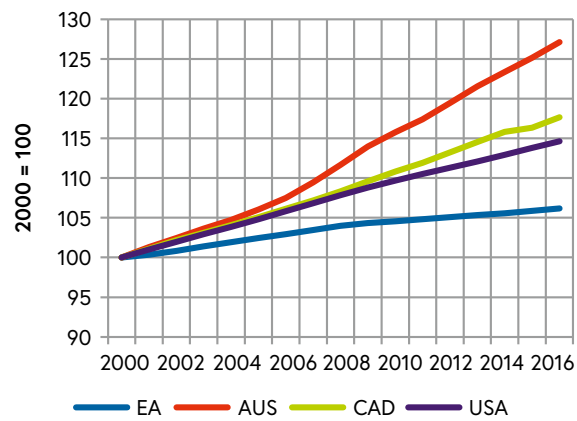
Nominal GDP growth



GDP p.c. in PPP growth



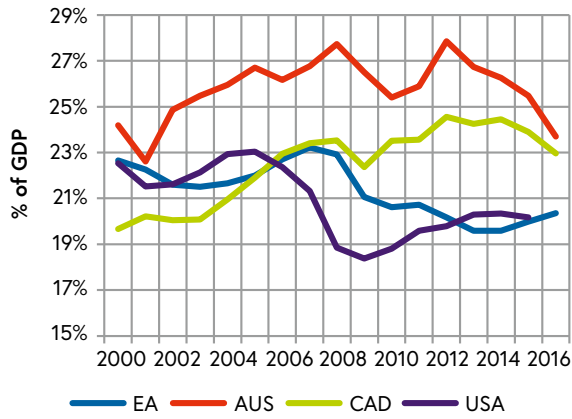
Population growth



Sources: OECD, own calculations

Figure 2: Gross Fixed Capital Formation

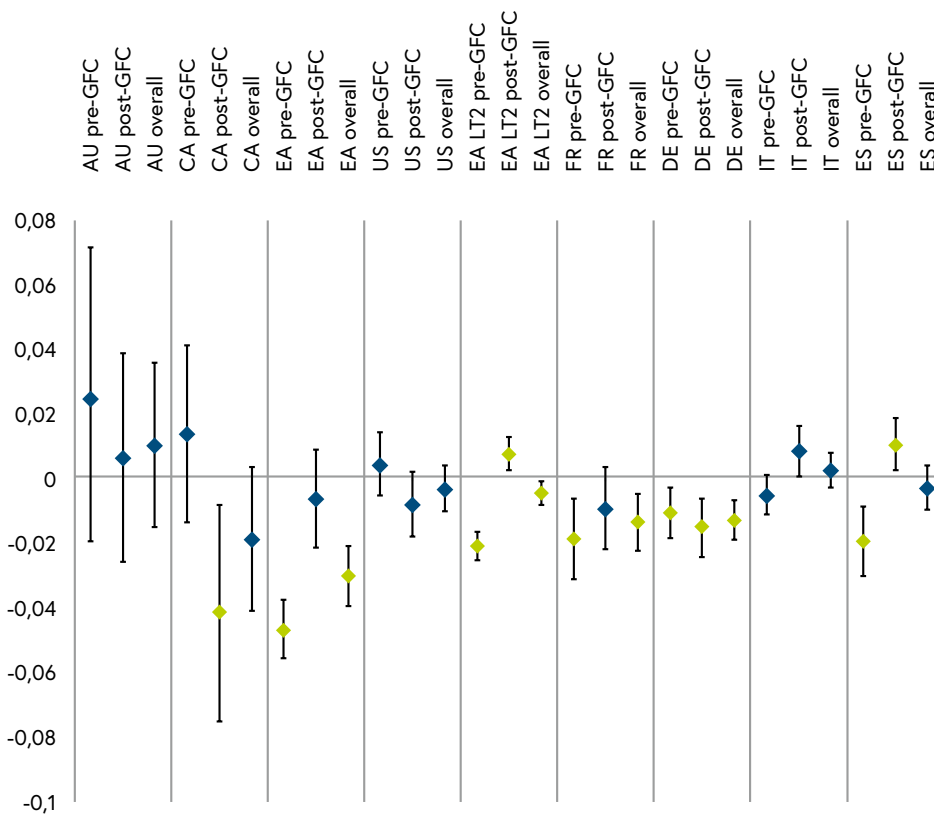
Gross Fixed Capital Formation



Sources: OECD, own calculations

Figure 3: Point estimates for Beta-convergence and 95 % intervals

pre-GFC indicates the period from 2001-2008, post-GFC from 2009-2016 and overall from 2000-2016. Green points indicate statistically significant point estimates.



Summary of main findings:

	Beta convergence	Sigma convergence & Theil's T	Resilience
US	No significant convergence	<p>Sigma: slightly increasing before crisis then slight reverse u-shape.</p> <p>Theil: after crisis very strong u-shape. Nose-dive after GFC and increase until 2016 to reach initial levels</p>	<p>Static: Overall state-dependent and comparable impact to EA</p> <p>Dynamic: slower than EA after dotcom and until Euro crisis.</p>
CA	Significant convergence after the crisis (not the kind you want)	<p>Sigma: inverse u-shape from 2000 to 2016 with some spikes</p> <p>Theil: two spikes; 2008, followed by drop in 2009, and 2014, afterwards again a sharp decline</p>	<p>Static: Four regions hit very hard by GFC. Others relative to US or EA very low impact.</p> <p>Dynamic: Very similar to EA (double dip), but strong recovery at the end</p>
AU	Statistically insignificant divergence	<p>Sigma & Theil: Steady rise until 2008. Reverse u-shape until 2016 (esp. Theil), reverting back to 2008 levels</p>	<p>Static: two worst hit territories by GFC lost 6-7% in real GDP PPP; by far lowest among worst hit regions.</p> <p>Dynamic: quickest to bounce back after both bubbles</p>
EA	Convergence stopped after GFC	<p>Sigma & Theil: Slight inverse u-shape from 2000-2016</p>	<p>Static: GFC impact large, however more equally distributed than in US-states; every large impact in GRC</p> <p>Dynamic: a bit quicker than US, however after GFC double dip</p>

Regression output for β -convergence

Australia	2000-2007	2008-2016	2000-2016
β	0,0242	0,0060	0,0097
p-value	0,2914	0,7114	0,4538

Canada	2000-2007	2008-2016	2000-2016
β	0,0131	-0,0419	-0,0194
p-value	0,3404	0,0143	0,0879

Euro area	2000-2007	2008-2016	2000-2016
β	-0,0473	-0,0067	-0,0307
p-value	0,0000	0,3756	0,0000

Euro area - LT 2	2000-2007	2008-2016	2000-2016
β	-0,0215	0,0071	-0,0052
p-value	0,0000	0,0082	0,0045

France	2000-2007	2008-2016	2000-2016
β	-0,0191	-0,0098	-0,0141
p-value	0,0030	0,1347	0,0023

Germany	2000-2007	2008-2016	2000-2016
β	-0,0113	-0,0156	-0,0135
p-value	0,0054	0,0009	0,0000

Italy	2000-2007	2008-2016	2000-2016
β	-0,0057	0,0078	0,0020

Italy	2000-2007	2008-2016	2000-2016
p-value	0,0753	0,0542	0,4466

Spain	2000-2007	2008-2016	2000-2016
β	-0,0199	0,0099	-0,0033

Spain	2000-2007	2008-2016	2000-2016
p-value	0,0004	0,0162	0,337

United States	2000-2007	2008-2016	2000-2016
β	0,0040	-0,0087	-0,0038
p-value	0,4168	0,0884	0,2945

List of abbreviations

ABBR.	Country
AUS	Australia
CAD	Canada
CFC	Central Fiscal Capacity
BICC	Convergence and Competitiveness
EA	Euro area
ECB	European Central Bank
COM	European Commission
EDIS	European Deposit Insurance Scheme
EIB	European Investment Bank
ESF	European Social Fund
ESM	European Stability Mechanism
GFC	Great Financial Crisis
GDP	Gross Domestic Product
IMF	International Monetary Fund
OLS	Ordinary Least Squares
OECD	Organisation for Economic Co-operation and Development
SSC	Social Security Contributions
USD	United States Dollars
USA	United States of America

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