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Revisiting Reinhart & Rogoff after the Crisis: A Time Series Perspective

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Abstract

This paper offers a straightforward and descriptive contribution to the recent and busy debate on fiscal discipline made popular by a seminal paper by Reinhart and Rogoff (2010) after policymakers have sought foundation and justification of a policy known as austerity measures following the recent sovereign debt crisis. We revisit the debate on whether or not higher debt levels impede growth rates and contribute by offering a time series perspective of a corrected data set and also a more recent and higher frequency source. We find that with further hindsight and from a time series perspective there is no support for the view that higher levels of debt cause reductions in economic activity.

Keywords: Austerity, Macroeconomic Policy, Fiscal Policy, Financial Crisis

JEL Classification: E60, E62, N10

1. Introduction

In the aftermath and seven years on from the beginning of the global financial crisis we revisit the popular debate on fiscal discipline that became crystallized in a controversial study by Reinhart and Rogoff (2010), the findings of which suggest that countries with higher debt/GDP ratios (of above 90%) were associated with impeded growth rates. Our contribution to this debate is a time series analysis that makes use of more recent and higher frequency data obtained from the OECD alongside a corrected version of the original data responsible for previous implications that austerity measures could be implemented to reactivate an economy in a deep recession. We find that there is little evidence to support the view that higher public debt levels dampen growth and further that the converse case, where depressions in output lead to higher debt, is more likely.

The financial crisis of 2007 brought an extraordinary slump in economic activity and a significant increase in gross government debt for almost all western countries. Increased borrowing and the need to recapitalise financial institutions left governments across Europe vulnerable in terms of borrowing ability and consequently facing a sovereign debt crisis. Even though the causality linkage between public debt and economic growth is rather complex and not yet fully understood, it is believed to be best described through a bidirectional relationship: In conventional views, public debt build-up, through increases in public spending, is assumed to have a positive short-run expansionary effect on demand, but also to crowd out capital and to hamper output growth in the

medium to long-run. On the other hand, low economic growth is also likely to induce higher public debt.

Given the rise in gross government debt figures across advanced nations, it is of little surprise that scholars have tried to find an answer to the question of whether or not economic growth is stifled by excessive public debt. Up until the unfolding of the financial crisis, there had been little research in this area. An influential study by Reinhart and Rogoff (2010) investigated the link between public debt and economic growth and found evidence of a debt-threshold (of 90%) at which economic growth is reduced by half. In an environment of surging public debt and crumbling growth rates, international organisations and policymakers have found their own interpretation of studies such as this to legitimise rigorous public spending cuts, commonly referred to as austerity measures, see Konzelmann (2012) for a discussion on the concept of austerity. Whereas the effectiveness and legitimacy of austerity measures are widely discussed in both the public, economic and political arenas, the findings in Reinhart and Rogoff (2010) have also provoked an extensive discussion in the field of applied economics. While numerous studies such as Cecchetti et al. (2011), Casni et al. (2014), Baum et al. (2012), Woo and Kumar (2010) or Caner et al. (2010) can be found in general support of the Reinhart and Rogoff (2010) claims, others report different results, Herndon et al. (2013), Chang and Chiang (2012), Panizza and Presbitero (2012) or even challenge this corner-stone paper for technical reasons, see Kourtellos et al. (2013) and Minea and Parent (2012) for examples.

This study offers further descriptive evaluation of the Reinhart and Rogoff (2010) hypothesis by analysing more recent, higher frequency data and a view that compares the period leading up to the crisis with that of the period of global recovery during the aftermath where economic activity has returned to more normal levels. As debt levels have risen consistently from the beginning of the financial crisis and at the time of writing are still increasing, this hypothesis benefits from a longer and time series perspective on the correlation between debt levels and growth. With the benefit of extended hindsight our study finds no clear-cut evidence in favour of the debt-threshold hypothesis and instead lends support to those that suggest a reverse causality where slumps in economic activity are largely responsible for increases in public debt.

In Section 2 we discuss the data sets used to compare the findings from the corrected set used by Reinhart and Rogoff (2010) and our higher frequency data from the OECD, after which we discuss our delineations in debt regimes and the methods of analysis. Section 3 discusses the results of the exploratory as well as statistical analysis using both sets of data and Section 4 concludes.

2. Methodology

We revisit the claims made by Reinhart and Rogoff (2010) by means of an exploratory data analysis motivated by Calhoun (2013). We utilise the corrected data set of that study which is provided by Herndon et al. (2013) in their effort to reproduce the results presented in Reinhart and Rogoff (2010). Furthermore, we employ an additional, more recent higher-frequency data set in order to investigate the correlation between the debt-to-GDP ratio and GDP growth rate for numerous OECD countries for the more recent period. Given the up-to-date nature of this data set, special emphasis is put on the effect of the financial crisis 2007/08 on these two key macroeconomic figures.

In order to evaluate the relationship between public debt and economic growth, we define three debt regimes. The first one is associated with the debt threshold postulated by Reinhart and Rogoff (2010) with a gross government debt to GDP ratio of above 90%. Apart from this high debt regime, we also introduce a middle regime with a debt-to-GDP ratio of between 50% and 90% as well as a low debt regime, with a corresponding ratio of below 50%. Additionally, we define a positive growth, a zero growth and a negative growth regime. These regimes are associated with a GDP growth rate of above 2%, between 0% and 2% as well as below 0% respectively.

The question we address is whether high debt levels are correlated with low GDP growth rates for a cross-country sample and with this in mind we plot the series of debt-to-GDP ratios as well as GDP growth rates associated with the previously defined regimes against time. We then evaluate any changes in GDP growth rates with respect to the corresponding debt regime as well as any changes in the debt-to-GDP ratio with respect to the given growth regime. Furthermore, we try to identify mutual, cross-country time patterns and discuss general cross-country patterns.¹

2.1. The Data

For the first part of the analysis we use the corrected data set of that study which is provided by Herndon et al. (2013).² A brief overview of this data set is provided in Table A.1. Additionally, we employ a more recent, higher-frequency data set providing monthly instead of annual figures for the same group of countries and the periods 1995Q01 to 2014Q01. This time series data is obtained from the OECD.StatExtract and is defined as follows:

- For the GDP growth rate (PGR from now on), ‘*quarterly growth rates of real GDP in change over same quarter, previous year*’ are taken from the OECD Quarterly National Accounts data set.³
- For the gross government debt ratio (DoG from now on), ‘*general government total gross debt in percent of GDP at current prices*’ from the Quarterly Public Sector Debt data set is used.⁴

We analyse the same group of countries as Reinhart and Rogoff (2010).⁵ A short overview on data availability and included countries is provided in Table A.2.

¹All computations were conducted using the statistical software *R* (R Core Team, 2014) and all data visualisations in this thesis were produced using ‘*ggplot2*’ by Wickham (2009). Code will be made available upon request.

²*R* code and data for Herndon et al. (2013) is provided at http://www.peri.umass.edu/fileadmin/pdf/working_papers/working_papers_301-350/HAP-RR-GITD-code.zip (last

visit August 2014).

³<http://stats.oecd.org/Index.aspx?DataSetCode=QNA> (last visit August 2014).

⁴http://stats.oecd.org/Index.aspx?DataSetCode=QASA_TABLE7PSD (last visit August 2014).

⁵Greece and New Zealand are not contained in the more recent data set.

3. Empirical results

In Figure 1 we plot the annual GDP growth rates from the Reinhart and Rogoff (2010) data set against time and highlight the high, middle and low debt regime with line colors red, blue and green respectively. As can be verified upon closer inspection, DoG exceeds a 90% threshold either at the very beginning of the sample or towards the end. Whereas the beginning of the sample can be associated with WWII and the re-building phase thereafter, the latter data observations reflect the beginning of the financial crisis. Between 1960 and 1980, the number of countries associated with the low debt regime is the highest. The general pattern of GDP growth rates is downwards-sloping for the investigated countries and periods. Consequently, with this negatively trending GDP growth rate, high debt occurring at the end of the sample is obviously going to be correlated with lower growth as well.

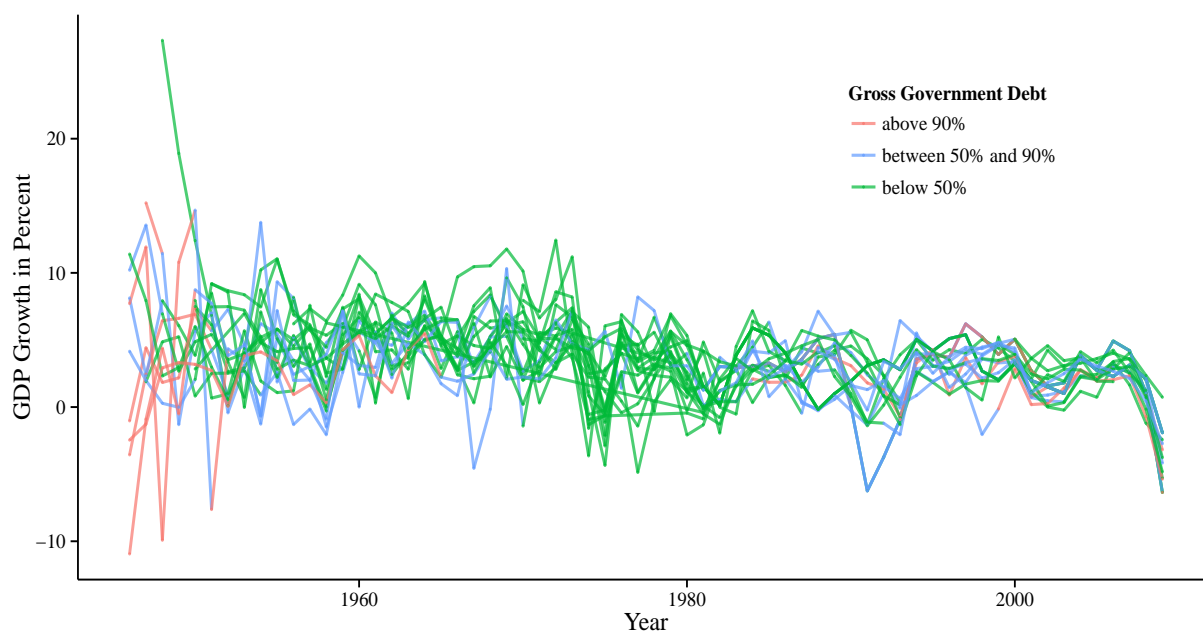


Figure 1: GDP Growth, 1946 to 2009

Figure 2 extends this analysis to the more recent high frequency sample. Using the same colour-coding scheme as before, we observe an interesting fact: Before the financial crisis, almost all countries in the sample recorded positive growth rates and seemed to move jointly. This trend continued during the crisis: Independently of the level of debt, all countries were struck by this seismic economic event. However, as a consequence of the financial crisis, many countries changed their debt-regime: Considerably more countries with high debt levels - corresponding to red lines with DoG > 90% - can be reported after 2010 with DoG measures of above 90%: As illustrated in B.5, before the financial crisis of 2007/08, the average number of countries associated with a high debt regime with a debt-to-GDP ratio of above 90% was approximately four. The first remarkable increase for this measure is reported for 2008Q10 and has increased ever since. For the most recent observation, more than 50% of the analysed countries can be associated with the

high debt regime.⁶ This observation allows one first conclusion on a possible correlation of both variables. Yet, in order to assess the effect of high debt levels on economic growth, one has to look at this data from another angle.

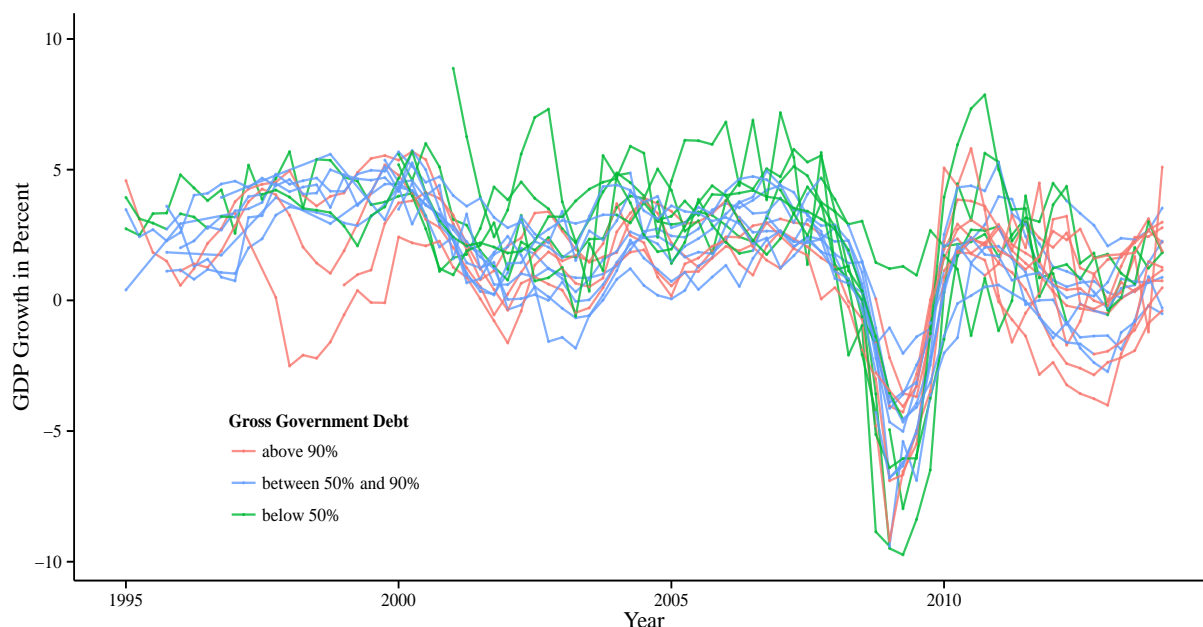


Figure 2: GDP Growth, 1995Q01 to 2014Q1

Taking a slightly different approach, in Figure 3 we again use the modified Reinhart and Rogoff (2010) data plots the level of DoG against time. Furthermore, we highlight periods with a GDP growth rate of above 2% in green, periods with growth rates between 0% and 2% in blue and periods with growth rates below 0% in red. As can be seen in this figure, low growth periods seem to follow an interesting pattern: Rather than being typically present for extremely high levels of DoG, low growth periods are scattered over time (and relatively present in the 1980s to mid-1990s) and clustered between countries. This is further unveiled by looking at the same plot setup, however evaluating all countries in the sample individually. In doing so B.6 offers some additional, interesting insight: First of all, as already noted, many countries report slumps in GDP growth around the same periods of time. Secondly, for numerous countries (e.g. Denmark, Finland, the US but also Italy), low growth periods seem to be followed by increases in the level of DoG. Thirdly, there does not appear to be any evidence that for any of these countries increasingly high sovereign debt is followed by a slump in GDP growth or that exceeding the 90% debt-threshold changes the pattern.

Conducting the same analysis for the more-recent OECD data set, we can confirm the previous results. Especially Figure 4 reveals some very interesting evidence. For all reported countries, independent of the actual level of gross debt, at least moderate growth rates could be reported up

⁶Figure B.7 summarises our findings by providing separate graphs for all countries investigated.

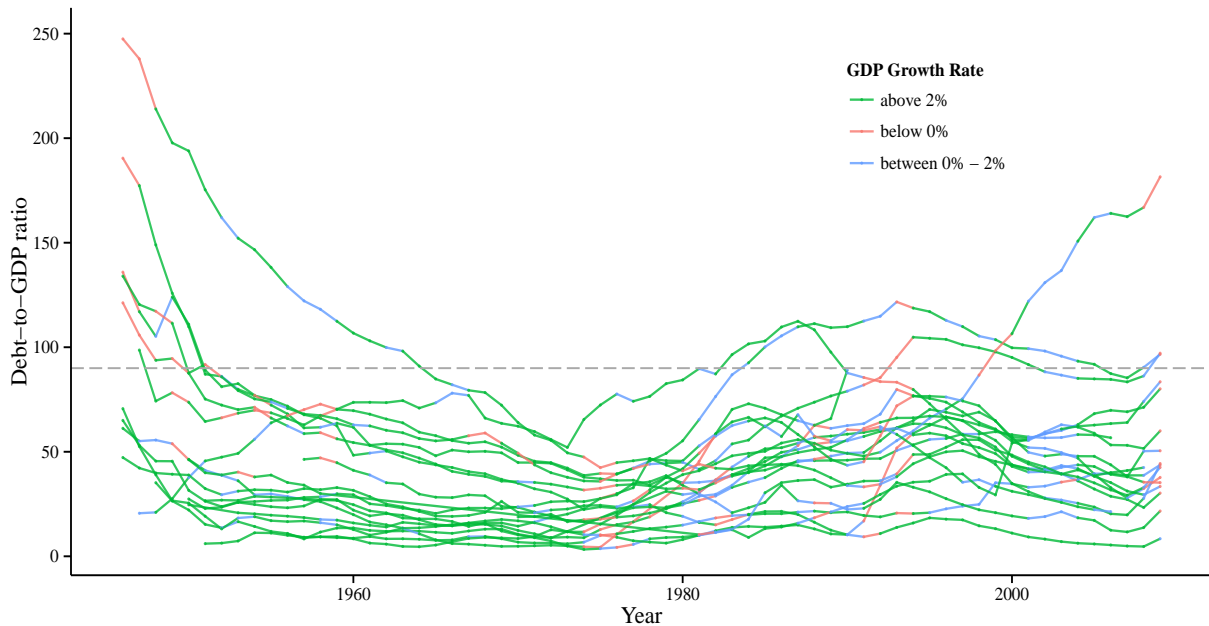


Figure 3: Debt-to-GDP ratio, 1946 to 2009

until the financial crisis. Then, a systematic shock for all countries could be reported with surging growth rates below 0% for all countries. What is interesting is that through the crisis, for most of the countries, debt levels came to a rise but for almost all countries GDP growth rates also switched their signs back to positive around the beginning of 2010. This can be seen in Figure B.8 which again evaluates all countries individually. For example, it is interesting to see that Italy, with a very high debt ratio which increased due to the crisis, also had growth rates return to normal in 2010. It was not before late 2011 that growth rates dropped to below zero again and it is unlikely that a second, unobserved debt-threshold level at 110% is to be blamed for that. This suggestion could be justified by an identical evolution observed for other countries including countries such as Ireland, Netherlands, Portugal and Spain, verified in the same figure. Even more so, it is quite remarkable that four out of these five countries are among the group of nations that suffered most through the financial crisis of 2007/08 and also had the most rigorous austerity programmes of European countries introduced.

The interesting results from all these graphs are as follows: GDP growth moves in broadly the same direction across different countries for both data sets investigated (Figures 1 and 2). Furthermore, a key insight of this analysis is that if lower levels of GDP growth anticipate a higher level of debt, more ‘red regimes’ before higher debt levels than for lower ones would generally have to be observed in Figures 3 and 4. What we see instead is that growth slumps, represented through red lines, generally happen before an increase in the debt level, but it does not matter what the initial level of the debt share was. Furthermore, neither data set indicates that for countries surpassing the 90% threshold line (indicated by a dashed grey line in both figures), a general change in the behaviour of either variable can be reported.

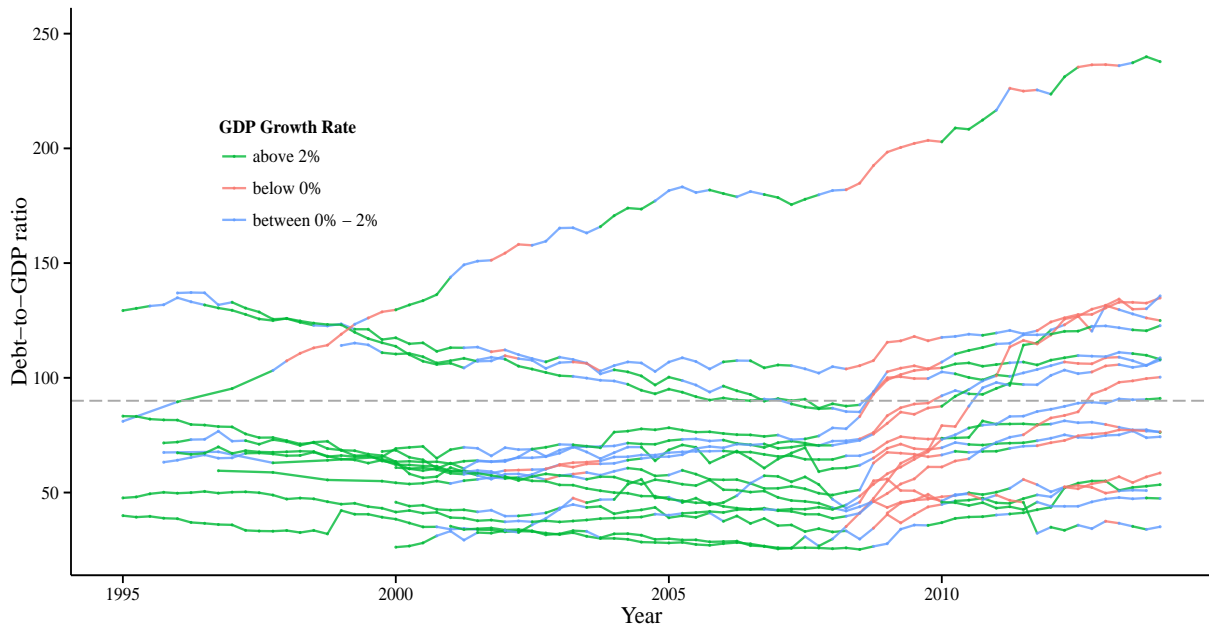


Figure 4: Debt-to-GDP Ratio, 1995Q01 to 2014Q1

We summarize the following points. First, low growth periods happen roughly at the same time across different countries, suggesting common elements being at least partially responsible for this. DoG appears to have common patterns across countries, yet over a very long period of time. This holds true for both data sets analysed. Secondly, low growth periods happen before an increase in DoG, but it does not appear to matter whether it is an increase to a low or high level of DoG. Following claims made in Reinhart and Rogoff (2010), low growth should happen at a high level of DoG and not be as likely as changes at low levels of sovereign debt. Furthermore, when looking at the actual DoG levels in Figure 4 or Figure B.8, further questions about the validity of the 90% threshold in Reinhart and Rogoff (2010) can be raised as most low growth periods of all countries lie below the 90% threshold and no obvious pattern can be observed when comparing this with all countries/periods that lie above this threshold line.

4. Conclusion

The argument on fiscal discipline and justification of measures to deal with over indebtedness by developed nations has attracted a good deal of interest fuelled by the seminal contribution by Reinhart and Rogoff (2010). The importance of this paper for policy impact cannot be understated and, since the realisation of various inaccuracies in methodology pointed out by Herndon et al. (2013) the argument has continued unabated. Our modest contribution to the debate uses the same data set, albeit corrected for the inaccuracies, and also a more recent and higher frequency time series perspective using data obtained from the OECD. We find that the time series perspective provides crucial evidence on a much debated possibility that growth can be endogenous on the level of external public debt. Previous studies have assumed that this causality is one way in

order to draw stronger policy relevant conclusions. However this assumption is limiting in its explanation and our study highlights this specifically. In fact, it seems that the time series view lends itself to the ‘reverse’ causality hypothesis that it is a fall in growth that causes debt and not vice versa. Firstly the times series plots for growth in GDP reveal a downward trend over the sample, a fact which could be the actual explanation for any negative correlation between debt and growth. Secondly, after the financial crisis the number of higher debt regimes exploded; a fact offering support for reverse causality of debt caused by economic slumps. Thirdly that periods of low growth for many countries tend to be clustered around common time periods offering further support for reverse causality. Finally, when we look at the individual country by country cases there is clear evidence that low growth periods are followed by higher debt-to-GDP regimes also supporting reverse causality. The evidence presented here highlights missing stylized facts that the panel type studies fail to reveal and suggest that, like Herndon et al. (2013), a much more rigorous analysis on the effects of higher public debt is required where the policy impact of a study is so high.

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Appendix A. Data

Table A.1: Summary Reinhart and Rogoff (2010) data set: No. of observations, annually from 1946 to 2009 (64 obs. max).

Country	Debt-to-GDP ratio	GDP growth
Australia	64	64
Austria	59	59
Belgium	63	63
Canada	64	64
Denmark	56	56
Finland	64	64
France	54	54
Germany	59	59
Greece	21	21
Ireland	63	63
Italy	59	59
Japan	54	54
Netherlands	53	53
New Zealand	61	61
Norway	64	64
Portugal	58	58
Spain	42	42
Sweden	64	64
UK	63	63
US	64	64

Table A.2: Summary OECD data set: No. of observations, quarterly from 1995Q1 to 2014Q1 (77 obs. max).

Country	Debt-to-GDP ratio	GDP growth
Australia	77	77
Austria	62	77
Belgium	77	73
Canada	77	77
Denmark	20	77
Finland	57	77
France	74	77
Germany	57	77
Ireland	62	53
Italy	61	77
Japan	69	77
Netherlands	58	77
Norway	57	77
Portugal	62	73
Spain	77	73
Sweden	74	77
UK	77	77
US	77	77

Appendix B. Additional Figures

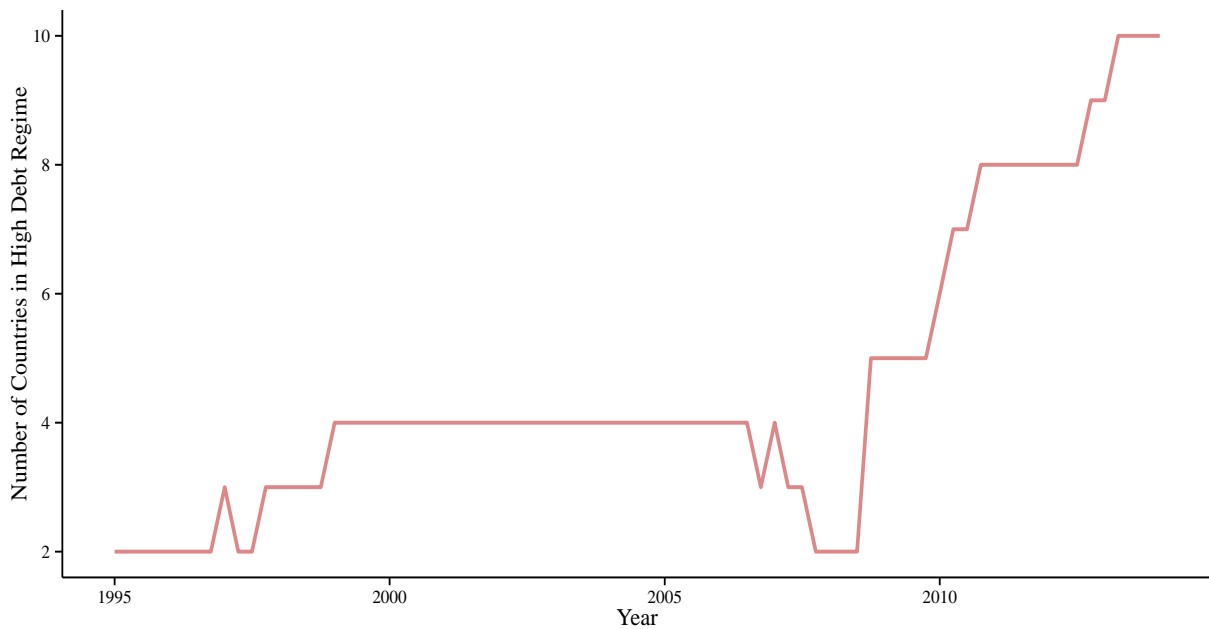


Figure B.5: Number of Countries with a Debt-to-GDP Ratio of Above 90%, 1995Q01 to 2014Q1

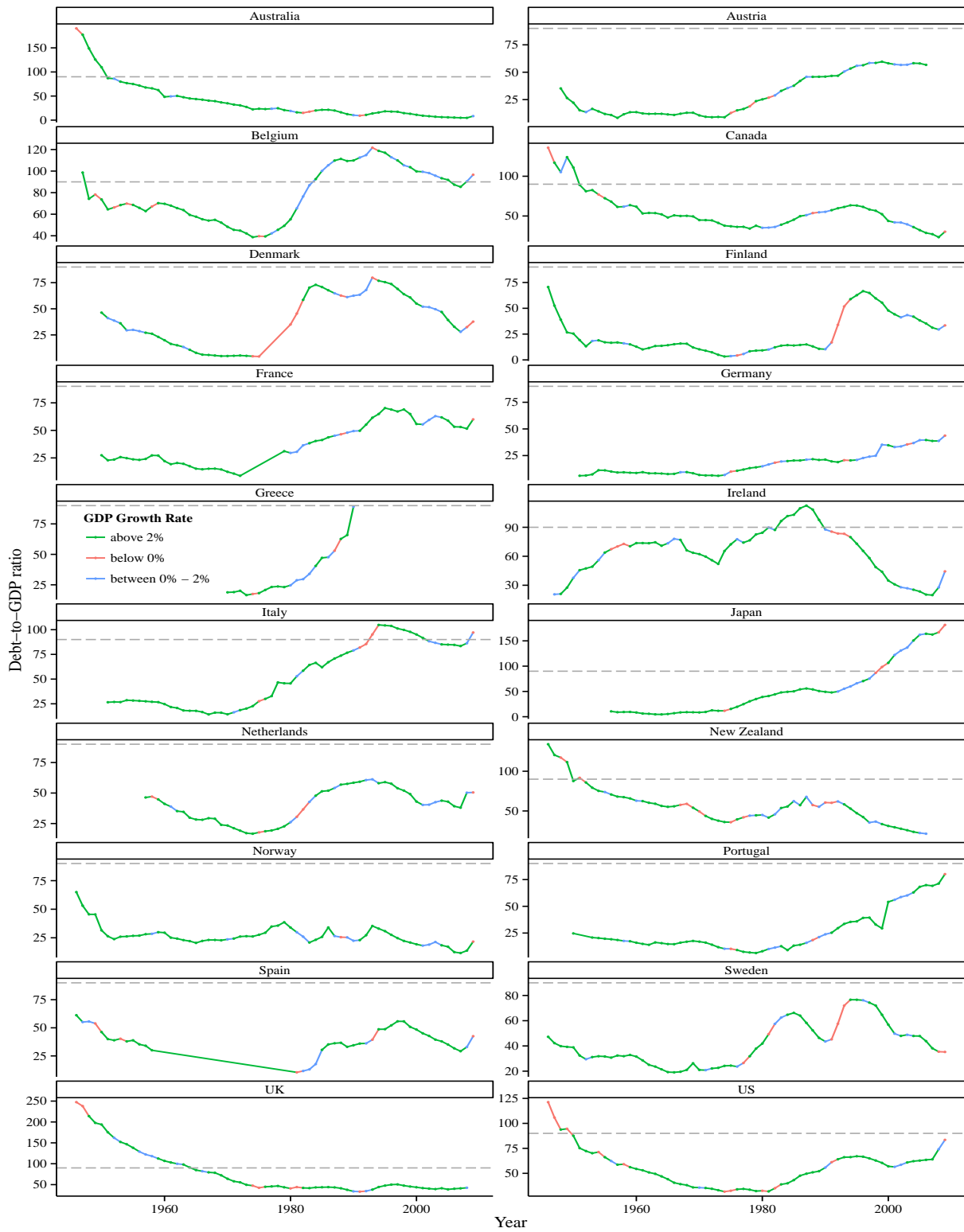


Figure B.6: Debt-to-GDP ratio, 1946 to 2009

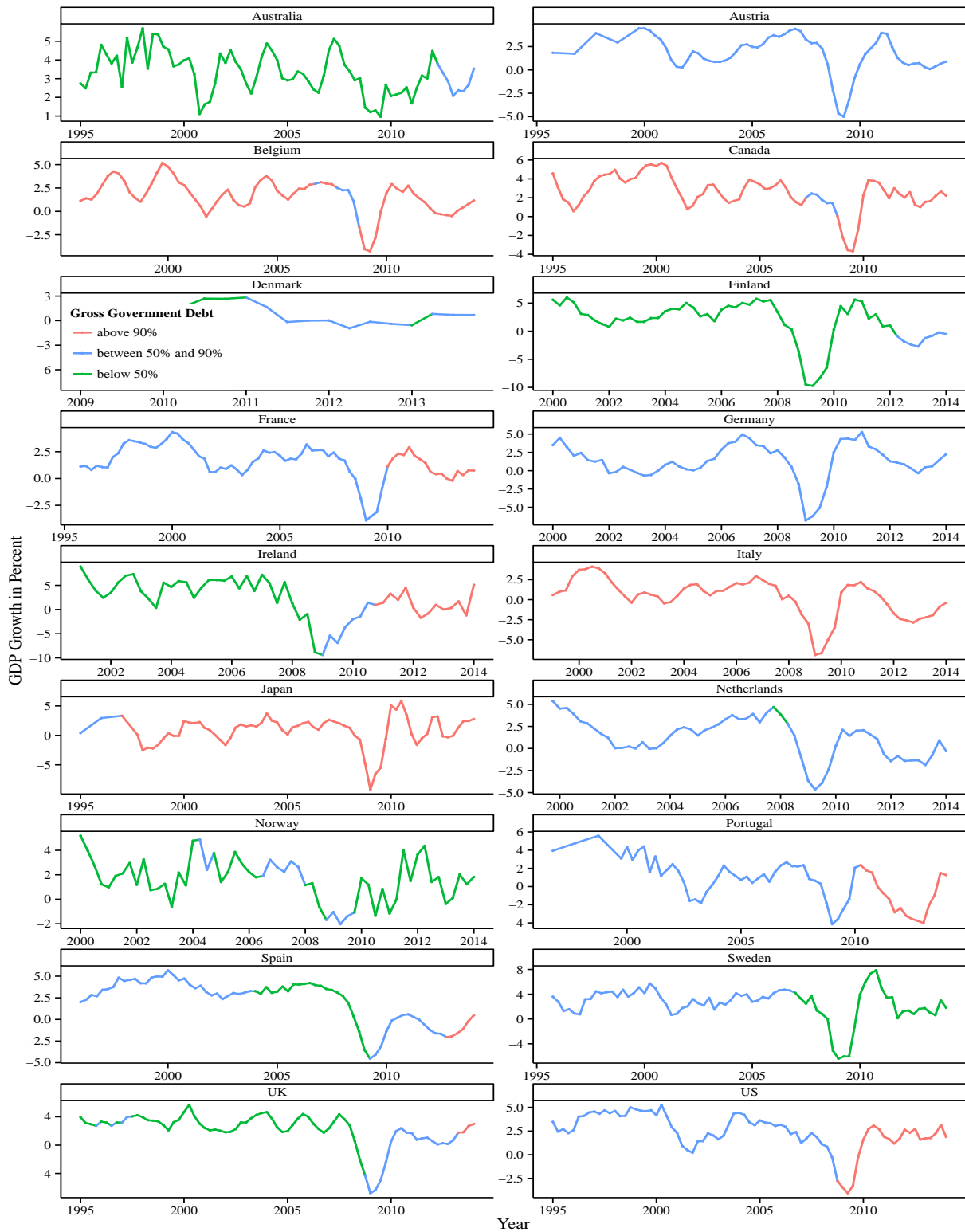


Figure B.7: GDP Growth, 1995Q01 to 2014Q1

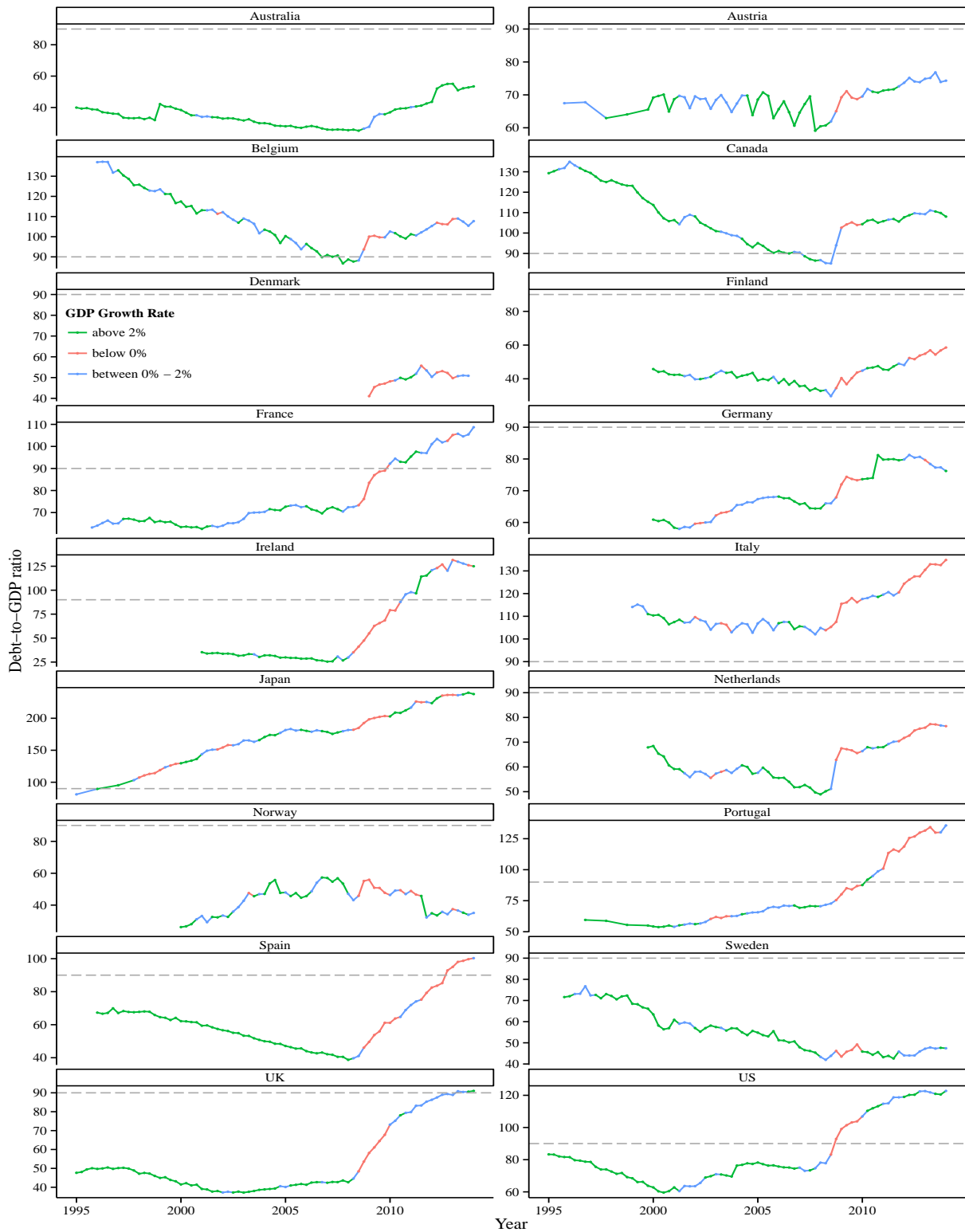


Figure B.8: Debt-to-GDP Ratio, 1995Q01 to 2014Q1