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Do countries default in bad times? The role of alternative detrending techniques

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ABSTRACT

Quantitative models of sovereign debt predict that countries should default during deep recessions. However, empirical research on sovereign debt has found a surprisingly large share of "good times" defaults (i.e., defaults that happen when GDP is above trend). Existing evidence also indicates that, on average, defaults happen when output is close to potential. This paper reassesses the empirical evidence and shows that the detrending technique proposed by Hamilton (2018) yields results that are closer to the predictions of standard quantitative models of sovereign debt.

1. Introduction

According to economic theory, sovereign defaults should happen during deep recessions. Using a standard quantitative model with persistent income shocks, Tomz and Wright (2007) find that 86% of defaults should happen when output is below trend and that, in the first year of default, output should be 7.4% below trend, on average. These predictions are not in line with several papers that show that about 40% of defaults happen when output is above trend and that, on average, in the first year of default output is only 1%–2% below trend (Aguiar and Amador, 2021, 2014; Tomz and Wright, 2013; Mitchener and Trebesch, 2021). This is a major puzzle in the sovereign default literature.

This paper aims at reconciling the data with theory by showing that alternative detrending techniques yield results which are closer to the predictions of baseline models of sovereign debt. Using the detrending technique suggested by Hamilton (2018), I find that only 20% of defaults happen in good times and that the output gap at the beginning of the average default episode is close to the output gap predicted by the quantitative model of Tomz and Wright (2007).

This paper is also related to the literature that studies the effects of alternative methods for separating the cyclical component of a time series from its underlying trend. A commonly used detrending technique in macroeconomics is the filter originally proposed by Hodrick and Prescott (1997) (hereafter HP). The HP filter has been the object of several types of criticisms (Bruchez, 2003; Wolf et al., 2020; King and Rebelo, 1993; Cogley and Nason, 1995; Harvey and Jaeger, 1993). Hamilton (2018) organizes and expands these various concerns and proposes an alternative detrending technique which uses the two-year-ahead OLS forecast based on the last 4 observations. He shows that this method is superior to the HP filter.

2. An example

Over the past 40 years, Argentina had 3 default spells which, overall, lasted for 15 years (1982–93, 2001–05, and 2019–2020).

Fig. 1 plots the evolution (in logs) of real local currency GDP (the solid line), trend GDP obtained with the HP filter (I follow Ravn and Uhlig, 2002, and set $\lambda = 6.25$; the filter is built using data for the period 1970–2020), and three vertical lines that mark the beginning of Argentina's three default episodes. The data show that defaults always happened when real GDP growth was negative (−1% in 1982, −5% in 2001, and −2% in 2019) and at least two percentage points below average real growth which, over 1970–2020, was about 1.8%.[1]

The fact that the three Argentinean defaults happened when GDP growth was both negative and below average suggests that they did not happen in good times. However, the output gap computed with the HP filter is positive for both the 2001 (0.2%) and the 2019 (2.6%) defaults. Thus, Fig. 1 illustrates that the finding that output gaps which tend to be small (or even positive) at the time of default could be an artifact of the HP filter. Fig. 1 follows Ravn and Uhlig (2002) and sets $\lambda = 6.25$. I find similar results with alternative values of λ. With the detrending technique suggested by Hamilton (2018), instead, I find large output gaps that range between −5% and −10%.

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[1] Growth was also negative in the years prior to the defaults: −5% in 1981, −1% in 2000, and −2.5% in 2018.

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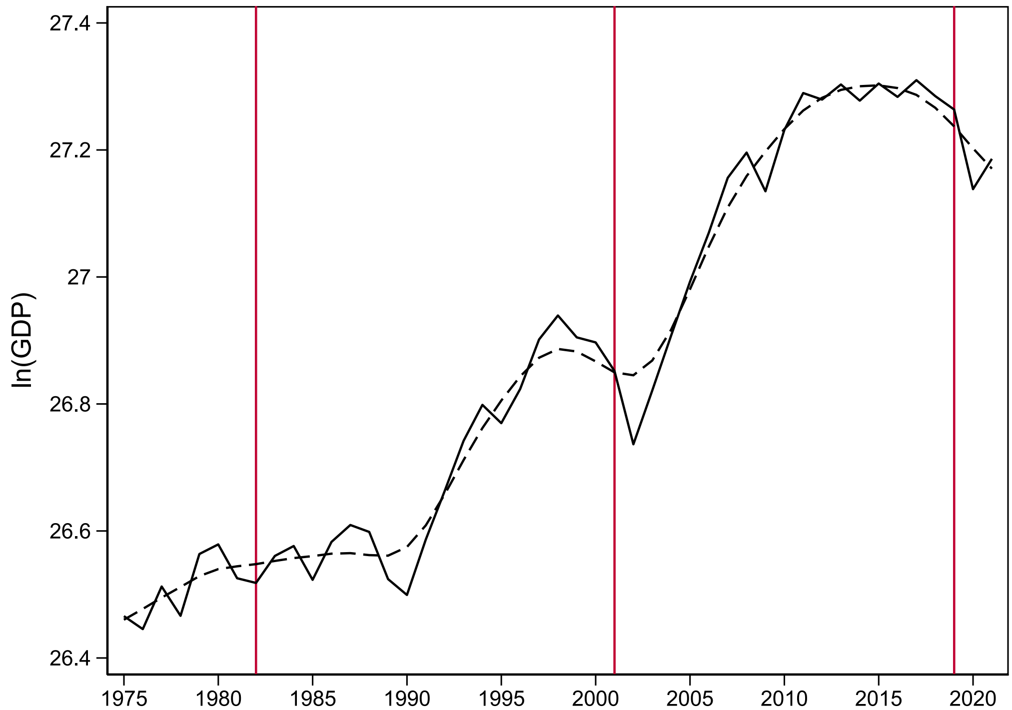

Fig. 1. Actual and trend real GDP in Argentina (1975–2020).

3. Evidence from four decades of defaults

Fig. 1 is a striking illustration of possible problems related to using the HP filter to determine whether countries default in bad times. However, Argentina is far from being representative of the sample of defaulters. I now move beyond anecdotal evidence and show that we can find similar patterns when we study all default episodes that took place between 1975 and 2020.

To build my sample of defaults, I start with the updated version of the dataset originally assembled by Asonuma and Trebesch (2016). While the dataset includes 196 default episodes, many of these episodes are just the continuation of a previous default event. I follow Reinhart and Rogoff (2009) and Reinhart and Trebesch (2016) and group the 196 default episodes into 95 default spells and then focus on the first year of each spell. For 16 of these spells, I do not have enough data to compute trend GDP. Thus, my final sample consists of 79 default episodes and 60 countries (Table 1). My sample is shorter but includes more recent data than the sample of Tomz and Wright (2007) and Benjamin and Wright (2013) who use data for 169 default spells over 1820–2004.

I use real GDP data for 1970–2020 to compute trend GDP and output gaps with the HP filter (with λ = 6.25 and λ = 400), the detrending technique suggested by Hamilton (2018), and a log-linear trend. I also compare GDP growth in the first year of the default episode with country-specific average GDP growth over 1970–2020. Table 1 reports the output gaps computed with the HP filter and the Hamilton detrending technique for all the episodes included in my sample. Table 2 summarizes the data.

Although my sample is smaller than that used in previous work, when I use the HP filter I can replicate the standard results that a relatively large share of defaults happen in good times and that the average output gap at the time of default tends to be small. Using 6.25 as smoothing parameter, I find that 35% of default episodes happen during good times and that the average output gap in the first year of a default spell is close to −1% (the median value is −0.07%, column 1 of Table 2). Setting λ = 400, I find that 44% of defaults happen when output is above trend and that the average output gap at the beginning of the default spell is −1.2% (the median value is −0.9%, column 2 of Table 2).

Things change when I compute trend growth with the two-year-ahead OLS forecast suggested by Hamilton (2018). Column 3 of Table 2 shows that the share of good-times defaults drops to 19% and the average output gap in the first year of default is now close to −7% (the median is −5.4%). These values are much closer to the theoretical predictions of a standard quantitative sovereign debt model (14% of good-times default and an average output gap of −7.4%; see last column of Table 2).

Column 4 shows that a log-liner trend would imply that good-times defaults are more frequent than bad-times defaults, and that the average output gap in the first year of default is small but positive.

Finally, column 5 compares GDP growth in the first year of a default spell with average country-specific GDP growth. The results are similar to those obtained with the Hamilton trend. Only 20% of defaults happen when GDP growth is above average, and, in the first year of the default spell, GDP growth is 4.5 percentage points lower than country-specific average GDP growth.

Fig. 2 plots the non-parametric distribution of the output gaps in the first year of default calculated with Hamilton's (2018) detrending technique (the solid black line) and with the HP filter with λ = 6.25 (the solid gray line) and λ = 400 (the dashed gray line). The distributions of output gaps computed with the HP filter tend to be approximately symmetric (this is in line with the penultimate row of Table 2 which shows negative but bigger than −0.5 skewness) and with a mode which is close to zero (−0.5% in both cases). The distribution of the output gap computed with the Hamilton trend is highly negatively skewed (−1.56), with a long left tail, and a mode which corresponds to an output gap of about -5%.

An inspection of the few good-times defaults signaled by the Hamilton output gap shows that a number of these events happened under special circumstances. For instance, South Africa defaulted in 1985 while under apartheid sanctions. Slovenia defaulted in 1992 immediately after becoming independent from Yugoslavia. Chad's 2014 default was associated with a large loan extended by Glencore to the state oil firm and that the company was unable to repay when oil prices

Table 1
Default episodes and output gaps.

Country	Year	Ham.	HP (λ=6.25)	HP ($\lambda = 400$)	Country	Year	Ham.	HP ($\lambda = 6.25$)	HP ($\lambda = 400$)
ALB	1991	−49.5	−13.1	−21.4	KEN	1992	−7.3	−1.1	0.8
ARG	1982	−10.6	−3.0	−1.5	KNA	2011	−4.2	−1.0	−3.1
ARG	2001	−7.3	0.2	−5.8	MAR	1983	−0.7	−2.0	−4.4
ARG	2019	−5.1	2.6	−1.0	MDA	2002	6.0	0.5	−5.4
BGR	1990	−22.6	1.0	8.0	MDG	1981	−9.2	−2.5	−2.5
BLZ	2006	1.3	0.9	3.9	MEX	1982	−1.1	2.2	9.2
BLZ	2012	0.8	0.0	0.6	MNG	2017	−0.4	−2.0	0.9
BLZ	2016	−1.2	−0.7	2.3	MOZ	1983	−33.6	−3.9	−4.8
BLZ	2020	−22.7	−9.3	−15.3	MOZ	2015	2.3	1.3	5.2
BOL	1980	−5.8	0.0	7.1	MRT	1992	−2.2	−1.4	−1.7
BRA	1982	−14.4	−0.7	−0.8	MWI	1982	−10.2	−3.1	−3.0
BRB	2018	−0.3	1.8	2.3	MWI	1987	−6.0	−0.9	−2.0
CHL	1983	−25.2	−6.3	−9.0	NER	1983	−6.9	3.1	5.1
CIV	1983	−9.9	−2.0	−2.7	NGA	1982	−27.3	−0.5	−2.7
CIV	2000	−7.6	−0.1	6.0	NIC	1978	−3.7	8.5	15.8
CMR	1985	5.7	1.8	17.1	PAK	1998	−5.4	−0.6	−2.2
COD	1975	−12.2	1.3	2.8	PAN	1984	−10.8	−2.0	5.0
COD	1982	−1.3	−1.0	−4.3	PER	1976	−3.4	1.6	5.0
COG	1983	9.4	5.3	19.1	PER	1983	−18.3	−7.1	−4.4
CRI	1981	−10.3	1.3	2.9	PHL	1983	−2.0	5.6	9.2
DMA	2003	−1.1	0.2	−3.6	PRY	1986	−0.1	−1.8	−5.1
DOM	1982	−4.4	0.0	3.0	RUS	1998	−4.9	−4.6	−20.7
DOM	2004	−7.4	−4.8	−6.5	SEN	1981	−1.2	−0.5	−0.9
DZA	1990	−2.8	1.3	1.2	SEN	1990	−3.4	−0.7	0.3
ECU	1982	−2.9	0.5	2.3	SLE	1980	5.0	0.8	1.5
ECU	1999	−8.0	−2.1	−5.0	SLV	1992	0.9	−0.1	−0.6
ECU	2008	3.6	1.5	1.7	SYC	2008	2.9	1.3	−1.1
ECU	2020	−12.6	−5.9	−12.3	TCD	2014	3.5	4.1	10.5
ETH	1990	−5.4	5.4	6.6	TGO	1987	−3.5	−2.3	−0.9
GAB	1986	−12.7	4.6	−2.2	TTO	1988	−8.5	−2.2	−11.4
GIN	1991	−0.2	−0.4	−0.7	TUR	1976	7.6	3.8	8.4
GMB	1984	3.8	2.6	2.7	TUR	1981	−6.4	−1.5	−5.2
GRC	2011	−10.0	−1.9	−3.0	UKR	1998	−3.8	−1.0	−25.0
GRD	2004	3.5	−3.6	1.4	UKR	2015	−11.7	−6.9	−9.7
GRD	2013	−2.1	−3.5	−8.6	URY	1983	−25.8	−6.7	−10.1
GUY	1982	−16.4	−1.8	0.8	URY	2003	−7.3	−4.7	−13.8
HND	1981	−8.8	0.0	1.4	VEN	1983	−11.0	−3.0	−7.1
IRQ	1986	−10.2	−3.5	0.0	ZAF	1985	0.7	−0.8	0.7
JAM	1977	−11.3	−2.1	−1.7	ZMB	1983	−11.5	−0.9	−1.2
JOR	1989	−25.4	−7.7	−12.6					

Table 2
Good-times defaults using alternative detrending techniques.

	HP ($\lambda = 6.25$)	HP ($\lambda = 400$)	Ham. Trend	Log-lin. Trend	$g_t > \mu$	Tomz & Wright Hist.	Tomz & Wright Model
"good times" defaults	35%	44%	19%	54%	20%	38.5%	14.1%
Average output gap (%)	−0.9%	−1.2%	−6.9%	0.2%	−4.5%	−1.6%	−7.4%
Median output gap (%)	−0.07%	−0.9%	−5.4%	1.3%	−2.7%		
St. dev. output gap	3.5%	7.7%	9.7%	14.3%	6.7%		
25th pctile of output gap	−2.2%	−4.8%	−10.6%	−6.2%	−6.2%		
75th pctile of output gap	1.3%	2.7%	−0.7%	7.7%	−0.9%		
Skewness	−0.47	−0.36	−1.56	−0.68	−1.78		
Number of episodes	79	79	79	79	79	169	

This table reports summary statistics for all the default episodes listed in Table 1. The first column computes the output gap using the HP filter with $\lambda = 6.25$, the second column uses the HP filter with $\lambda = 400$, the third column uses the detrending technique suggested by Hamilton (2018), the fourth column uses a log-linear trend, the fifth column compares GDP growth in the year of the default with average GDP growth over 1970–2020 (all variables in this column should be interpreted as deviations from average growth and not as output gaps), and the last two columns report historical values and permanent shock simulations from Table 1 of Tomz and Wright (2007).

collapsed at the end of 2014 (Coulibaly et al., 2019). Mozambique's 2015 default, instead, was linked with the Tuna Bonds corruption case (Connelly, 2021).

A particularly interesting case is the Ecuadorian default of 2008. This is a rare case of debt restructuring in the absence of any type of financial stress as, at the time of default—output was nearly 4% above trend and GDP growth was well above 6%. It is well documented that this default was purely a political decision based on President Rafael Correa's electoral promise to refuse to pay the country's external debt if elected (Feibelman, 2017).

4. Conclusions

While economic theory predicts that countries should default during bad times, the empirical sovereign debt literature has identified a surprisingly large number of defaults that happen when output is above trend. This paper shows that the detrending methodology suggested by Hamilton (2018) can reconcile the empirical evidence with the predictions of standard quantitative models of sovereign debt.

A quick look at the good-times defaults identified by the Hamilton trend shows that about one-third of these defaults happened under exceptional circumstances. It is thus possible that a careful analysis of

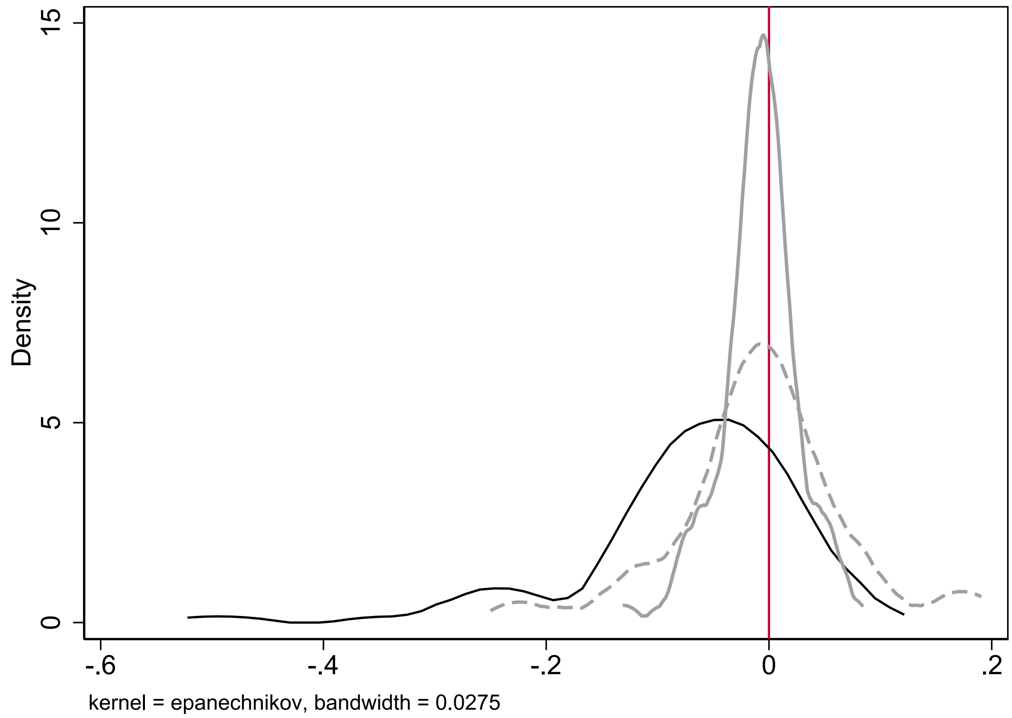

Fig. 2. Distribution of output gaps using alternative detrending techniques. This figure plots the non-parametric distributions of the output gap in the first year of default. The solid black line plots the distribution of the output gap obtained with the Hamilton detrending technique and the gray lines plot the distribution of the output gap obtained with the HP filter with 6.25 (solid line) and 400 (dashed line) smoothing parameters.

non-economic drivers of default (see, for instance, Esteves et al., 2021) could further reduce the gap between theory and data.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability

Data will be made available on request.

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