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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.

JEL Codes: F34; F32; H63
Keywords: Sovereign Debt; Default, Business Cycles

1 Introduction

According to economic theory, sovereign defaults should happen during deep recessions. However, several authors found that nearly 40% of default episodes happen when output is above trend and that, at the beginning of the average default episode, the output gap is nearly five times smaller than what is predicted by standard quantitative models of sovereign debt (for surveys, see Tomz and Wright, 2013, Aguiar and Amador, 2021, Aguiar and Amador, 2014, and Uribe and Schmitt-Grohe, 2017). This is a major puzzle in the sovereign default literature.

This note 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 note builds on two strands of literature. The first strand relates to 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).[1] The HP filter has been the object of several types of criticisms. Two well-known issues are the "end-point bias" (i.e., the fact that the last observation has a large impact on the behavior of the trend at the end of the series) and the fact that the filter artificially predicts the future because it includes future realizations. While these issues can be addressed with appropriate techniques (see, among others, Bruchez, 2003, and Wolf, Mokinski, and Schüler, 2020), several authors show that the HP filter can misrepresent the underlying data. For instance, King and Rebelo (1993) suggest that the conditions under which the HP filter is an optimal filter are "unlikely to be even approximately true in practice" (p. 230). Cogley and Nason (1995) and Harvey and Jaeger (1993) add that, when applied to persistent series, the HP filter can generate business cycle fluctuations even when such fluctuations do not exist in the underlying data. Furthermore, the patterns revealed by the filtered data are often an artifice of the filter itself. Phillips and Jin (2021) also show that, contrary to what is normally assumed in macroeconomics, the HP filter does not typically make a non-stationary series stationary. The same authors conclude that the HP filter can be a useful instrument but that it needs to be used with care and with priors that incorporate economic assumptions about the underlying process.

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 observa-

[1] While the paper that describes the HP filter was published in 1997, the filter has been commonly used in macroeconomics since 1981 when Hodrick and Prescott first circulated their paper. Earlier versions of the filter were developed by Bohlmann (1899), Whittaker (1923), and Henderson (1924).

tions. He shows that this method is superior to the HP filter and, in an article provocatively entitled "Why You Should Never Use the Hodrick-Prescott Filter," concludes that the HP filter:

> ... introduces spurious dynamic relations that are purely an artifact of the filter and have no basis in the true data-generating process, and there exists no plausible data-generating process for which common popular practice would provide an optimal decomposition into trend and cycle. (Hamilton, 2018, p. 839)

The HP filter has its defenders. Drehmann and Yetman (2018) suggest that the filter can be useful for estimating credit gaps, and Phillips and Shi (2021) show that it is possible to use machine-learning to build a "boosted" version of the HP filter that can address Hamilton's criticisms.

This note is also related to the literature on the timing of sovereign default. This literature builds on Eaton and Gersovitz's (1981) seminal paper and starts from the assumption that sovereign immunity prevents private creditors from legally enforcing sovereign debt contracts.[2] Given that sovereign debtors cannot be forced to repay, they will repay only if they perceive non-payment as the more costly alternative. Hence, it is the cost of default that makes sovereign debt possible.

In the presence of state-contingent debt (for instance, a GDP-indexed bond that stipulates that the country only makes payments when GDP growth is above a certain threshold), countries would be tempted to default in "good times" (because no payments are required in bad times). Knowing this, risk-neutral lenders will only lend up to the point in which the cost of default is equal to the maximum possible payment; therefore, the borrowing sovereign will always prefer to honor its debts. This situation leads to an equilibrium in which countries never default.

Things are different under the more realistic assumption of non-state contingent debt contracts. In this case, the borrower needs to pay principal and pre-determined interest at the end of each period (most models assume one-period debt), independently of the state of the economy. With concave preferences, the cost of paying (in terms of foregone consumption) will be higher in bad times, leading to a situation in which countries are more likely to default during deep recessions (Uribe and Schmitt-Grohe, 2017). 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.[3]

[2] For a critical evaluation of this assumption, see Gelpern and Panizza (2022).

[3] A quantitative model with transitory shocks finds that 100% of defaults should happen in bad times and that the average output gap in the first year of default should be -42%.

These predictions are consistent with Levy Yeyati and Panizza's (2011) finding that defaults tend to coincide with the trough of the business cycle. However, they 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, Aguiar and Amador, 2014, Tomz and Wright, 2013, and Mitchener and Trebesch, 2021).[4] I show that alternative trending techniques yield patterns which are closer to the predictions of quantitative models of sovereign debt.[5]

The paper is organized as follows. Section 2 uses the case of Argentina to illustrate the pitfalls of using the HP filter to study whether countries default in bad times. Section 3 moves beyond anecdotal evidence and uses data for all default episodes over the period 1975-2020 to show that alternative detrending techniques can help in reconciling theory with the data. Section 4 concludes.

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).

Figure 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 λ=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%.[6]

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, Figure 1 illustrates that the finding that output gaps which tend to be small (or even positive) at the time of default could be an artefact of the HP filter.

While Figure 1 follows Ravn and Uhlig (2002) and sets λ=6.25, Tomz and Wright (2007) follow Cooley and Ohanian (1991) and set λ=400, but also experiment with λ=6.25 and λ=100 (Backus and Kehoe, 1992). If I set λ=400, I find that in all 3 Argentinean defaults output is below trend, but the output gaps remain small (-1.5% in 1982 and -1% in 2019). With the detrending technique suggested by Hamilton (2018), instead, I find large output gaps that range between -5% and -10%.

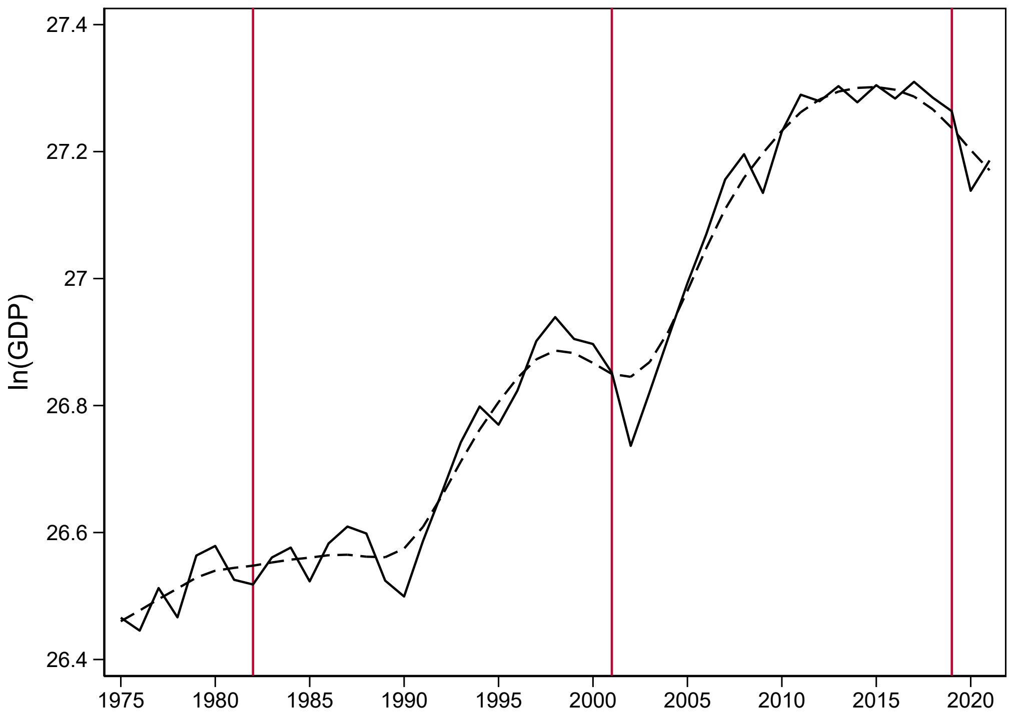
[4] There is also evidence that emerging market countries with higher income per capita are relatively more likely to default in good times (Durdu, Nunes, and Sapriza, 2013).

[5] I abstract from the issue that, in emerging markets, the idea of separating cycle and trend may not make sense to start with (Aguiar and Gopinath, 2006).

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

Figure 1: Actual and Trend Real GDP in Argentina (1975-2020)

This figure shows the behavior of log real local currency GDP (the solid black line) together with the Hodrick Prescott trend (the dashed black line) computed setting λ=6.25 and using data for the period 1970-2020. The vertical lines mark the beginning of Argentina's three default spells (1982, 2001, and 2019).



Although the choice of the smoothing parameter matters (Phillips and Jin, 2021 show that this choice should depend on both the frequency of the data *and* sample size), Tomz and Wright (2007) show that their results are robust to alternative smoothing parameters.

3 Evidence from Four Decades of Defaults

Figure 1 is a striking illustration of possible problems related to using the HP filter to determine whether countries default in bad times. However, with 3 default episodes in less than 40 years, Argentina is far from being representative of the sample of defaulters. In this section, I 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.

In order 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. For instance, Asonuma and Trebesch (2016) list 6 consecutive default episodes for Brazil over 1982-1994.

Rather than considering consecutive defaults as separate events, I follow Reinhart and Rogoff (2009) and Reinhart and Trebesch (2016) and group the 196 default episodes into 95 default spells. I 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).[7] The sample includes 2 countries with 4 default spells (Belize and Ecuador; note that Belize defaulted again in 2021, but this default is not in my sample), one country with 3 default spells (Argentina), 11 countries with 2 default spells, and 46 countries with one default spell. 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.[8] 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. Specifically, 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 dramatically 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).

[7] I source data on real local currency GDP from the World Bank's World Development Indicators (WDI). Given that WDI data end in 2018, I update the series to 2020 using data from the World Economic Outlook database maintained by the International Monetary Fund. The default spells for which I cannot compute trend GDP are: Bosnia and Herzegovina, 1992; Croatia, 1991; Guinea, 1985; Liberia, 1980; Macedonia 1992; Poland, 1981; Romania, 1981; Russia, 1991; Sudan, 1975; Serbia, 1992; Sao Tome and Principe 1984; Tanzania, 1981; Uganda, 1981; Vietnam 1982; Yemen 1983; and Yugoslavia, 1983.

[8] The panel is unbalanced because not all countries have GDP data going back to 1970. In fact, some countries included in the sample achieved independence after 1970.

Table 1: Default Episodes and Output Gaps

This table lists all the default episodes studied in the paper, together with their relative output gaps computed using the HP filter with λ=6.25 and λ=400 and the detrending technique suggested by Hamilton (2018).

Country	Year	Ham.	HP (λ=6.25)	HP (λ=400)	Country	Year	Ham.	HP (λ=6.25)	HP (λ=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

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 λ=6.25, the second column uses the HP filter with λ=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).

	HP (λ=6.25)	HP (λ=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	

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.

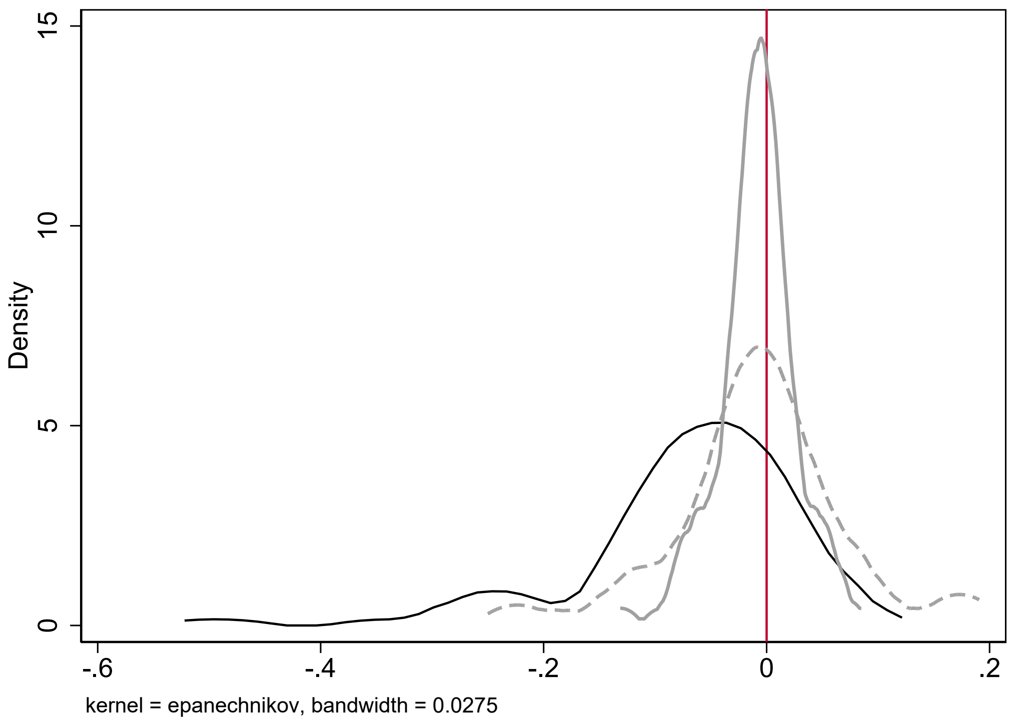
Finally, column 5 compares GDP growth in the first year of a default spell with average country-specific GDP growth. The results are similar to those obtained with the Hamilton trend. Only 20% of defaults happen when GDP growth is above average, and, in the first year of the default spell, GDP growth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

Figure 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 collapsed at the end of 2014 (Coulibaly, Gandhi, and Senbet,

Figure 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.



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 in good times (i.e., when output is above trend). This paper reassesses this empirical literature and shows that alternative methods to separate business cycle fluctuations from trend growth yield different results. Specifically, 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 non-economic drivers of default (see, for instance, Esteves, Kelly, and Lennard, 2021) could further reduce the gap between theory and data.

References

Aguiar, Mark, and Manuel Amador (2014): "Sovereign debt," in *Handbook of International Economics*, vol. 4. Elsevier.

——— (2021): *The Economics of Sovereign Debt and Default*. Princeton University Press.

Aguiar, Mark, and Gita Gopinath (2006): "Defaultable Debt, Interest Rates and the Current Account," *Journal of International Economics*, 69(1), 64–83.

Asonuma, Tamon, and Christoph Trebesch (2016): "Sovereign Debt Restructurings: Preemptive or Post-Default," *Journal of the European Economic Association*, 14(1), 175–214.

Backus, David, and Patrick Kehoe (1992): "International Evidence of the Historical Properties of Business Cycles," *American Economic Review*, 82(4), 864–88.

Benjamin, David, and Mark Wright (2013): "Recovery Before Redemption: A Theory of Delays in Sovereign Debt Renegotiations," Working paper.

Bohlmann, George (1899): "Ein Ausgleichungsproblem," *Nachrichten von der Gesellschaft der Wissenschaften zu Gottingen, Mathematisch-Physikalische Klasse*, pp. 260–271.

Bruchez, Pierre-Alain (2003): "A Modification of the HP Filter Aiming at Reducing the End-Point Bias," Working Paper 18, Swiss Federal Finance Administration.

Cogley, Timothy, and James Nason (1995): "Effects of the Hodrick-Prescott filter on trend and difference stationary time series Implications for business cycle research," *Journal of Economic Dynamics and Control*, 19(1-2), 253–278.

Connelly, Stephen (2021): "The Tuna Bond Scandal: The Continued Lack of Transparency in Bank-to-State Credit Facilities Agreements," *Journal of International Economic Law*, jgab029.

Cooley, Thomas, and Lee Ohanian (1991): "The cyclical behavior of prices," *Journal of Monetary Economics*, 28(1), 25–60.

Coulibaly, Brahima, Dhruv Gandhi, and Lemma Senbet (2019): *Is Sub-Saharan Africa Facing Another Systemic Sovereign Debt Crisis?* Washington DC: Brookings Institution Africa Growth Initiative Policy Brief.

Drehmann, Mathias, and James Yetman (2018): "Why you should use the Hodrik-Prescott filter -at least to generate credit gaps," Working Paper 744, Bank for International Settlements.

Durdu, C. Bora, Ricardo Nunes, and Horacio Sapriza (2013): "News and sovereign default risk in small open economies," *Journal of International Economics*, 91(1), 1–17.

Eaton, Jonathan, and Mark Gersovitz (1981): "Debt with potential repudiation: Theoretical and empirical analysis," *The Review of Economic Studies*, 48(2), 289–309.

Esteves, Rui, Seán Kelly, and Jason Lennard (2021): "The Aftermath of Sovereign Debt Crises: A Narrative Approach," Working Paper 16166, CEPR.

Feibelman, Adam (2017): "Ecuador's 2008–2009 Debt Restructuring," in *Sovereign Debt Crises What Have We Learned?*, ed. by J. P. Bohoslavsky, and K. raffer. Cambridge: Cambridge University Press.

Gelpern, Anna, and Ugo Panizza (2022): "Enough Potential Repudiation: Economic and Legal Aspects of Sovereign Debt in the Pandemic Era," *The Annual Review of Economics*, (forthcoming).

Hamilton, James D. (2018): "Why You Should Never Use the Hodrick-Prescott Filter," *The Review of Economics and Statistics*, 100(5), 831–843.

Harvey, Andrew C., and Albert Jaeger (1993): "Detrending, Stylized Facts and the Business Cycle," *Journal of Applied Econometrics*, 8(3), 231–247.

Henderson, Robert (1924): "A New Method of Graduation," *Transactions, Actuarial Society of America*, 25(I-71), 29–40.

Hodrick, Robert J, and Edward C Prescott (1997): "Postwar U.S. Business Cycles: An Empirical Investigation," *Journal of Money, Credit and Banking*, 29(1), 1–16.

King, Robert, and Sergio Rebelo (1993): "Low frequency filtering and real business cycles," *Journal of Economic Dynamics and Control*, 17(1-2), 207–231.

Levy Yeyati, Eduardo, and Ugo Panizza (2011): "The elusive costs of sovereign defaults," *Journal of Development Economics*, 94(1), 95–105.

Mitchener, Kris, and Christoph Trebesch (2021): "Sovereign Debt in the 21st Century: Looking Backward, Looking Forward," Working Paper 15935, CEPR.

Phillips, Peter, and Sainan Jin (2021): "Business Cycles, Trend Elimination, and the HP Filter," *International Economic Review*, 62(2), 469–520.

Phillips, Peter, and Zhentao Shi (2021): "Boosting: Why you Can Use the HP Filter," *International Economic Review*, 62(2), 521–570.

Ravn, Morten, and Harald Uhlig (2002): "On adjusting the Hodrick-Prescott filter for the frequency of observations," *The Review of Economics and Statistics*, 84(2), 371–375.

Reinhart, Carmen, and Kenneth Rogoff (2009): *This Time is Different: Eight Centuries of Financial Folly*. Princeton NJ: Princeton University Press.

Reinhart, Carmen M, and Christoph Trebesch (2016): "Sovereign Debt Relief and its Aftermath," *Journal of the European Economic Association*, 14(1), 215–251.

Tomz, Michael, and Mark Wright (2007): "Do Countries Default in "Bad Times"?," *Journal of the European Economic Association*, 5(2/3), 352–360.

——— (2013): "Empirical research on sovereign debt and default," *Annual Review of Economics*, 5(1), 247–272.

Uribe, Martin, and Stephanie Schmitt-Grohe (2017): *Open Economy Macroeconomics*. Princeton, NJ: Princeton University Press.

Whittaker, Edmund Taylor (1923): "On a New Method of Graduation," *Proceedings of the Edinborough Mathematical Society*, 41, 63–75.

Wolf, Elias, Frieder Mokinski, and Yves Schüler (2020): "On adjusting the one-sided Hodrick-Prescott filter," Bundesbank Discussion Paper 11/2020.