

A simple empirical investigation into the optimal size of the NGDP Target and Level targeting

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Abstract This paper constructs an index to study two questions within a growing school of macroeconomic thought, Market Monetarism. This school argues that the central bank has full control over all nominal variables in the economy and is solely responsible for aggregate demand management. To manage aggregate demand, Market Monetarism argues the central bank should target Nominal GDP. We address two issues of contention. First, we measure the optimal size of the optimal NGDP target. Second, we measure the extent to which central banks should engage in level targeting, i.e., whether central banks should correct for past errors when hitting their targets. We find evidence consistent with a five percent target but are unable to find consistent evidence regarding level targeting.

Keywords Market monetarism · NGDP targeting · Level targeting · Misery index

JEL Classification E3 · E5

1 Introduction

As the Great Recession persisted at the turn of the decade, most economists agreed the cause of unemployment was a shortfall in aggregate demand. Central banks continued cutting rates until they backed up against the zero lower bound associated with interest rate targeting. In accordance with introductory textbooks, economists called for fiscal stimulus. However, a small group of economists, later to be known as “Market

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Monetarists,” claimed this advice went against modern mainstream macroeconomic research: monetary stimulus remains highly effective even at the zero lower bound.

Market Monetarists argue that the adequate and sufficient level of aggregate demand can always be achieved by targeting the path of Nominal Gross Domestic Product. NGDP targeting was discussed within academia during the 1980s although it was never formally adopted (see, e.g., Meade 1978; Bean 1983; Frankel 1995).¹ Its revival has mostly appeared on the blogosphere, although discussions have also appeared in academic journals (e.g. Sumner 2014; Beckworth 2011; Hendrickson 2012; Murphy 2013), and in reality perhaps the proposal had never truly lost prominence amongst macroeconomists (Kim and Henderson 2005; Guender 2007; McCallum 2015; Sumner 2015). More importantly, perhaps, the argument for NGDP targeting has had a significant impact on discussions within and around central banks (for example, see Aldrick and Carney 2012; Romer 2011).

The intention of this paper is to make a serious scholarly inquiry into two internal issues of contention within Market Monetarism. The first is straightforward: what rate of NGDP growth are we meant to target? The median belief appears to favor a target around 5 % per year. Others radically argue for a 0 % target, and arguing for a target greater than 5 % is certainly imaginable. The second question is concerned with to what extent central banks should *level* target. If NGDP falls off its expected path, should the central bank “catch up” in future periods? With the significant deviation from NGDP trend growth following the commencement of the Great Recession, a level target may require further significant price level inflation to return NGDP to where it “should” be. Moreover, should level targeting have a long memory? That is, should central banks consider the path of NGDP from several years ago in determining the desired path of NGDP growth today?

Our strategy is to allow the data to tell us which policies correspond to the best outcomes. We construct an index of historical NGDP growth rates, evaluating them against inflation and unemployment rates. Our index contains a parameter corresponding to the magnitude of the NGDP target and a parameter corresponding to what extent level targeting should be employed. Country-level data dictates the values of the parameters. In some ways, this is similar to developing a prescriptive policy rule, as in Taylor (1993). In contrast, however, the path of NGDP is used explicitly to minimize future inflation and unemployment rates, instead of using past inflation and output gap data to dictate the path of interest rates.

One point that should be emphasized is that this paper makes no claim to provide evidence in favor of NGDP targeting or Market Monetarism over alternative monetary policies or macroeconomic schools of thought. Yet, although it takes certain tenets of Market Monetarism for granted, it still promises to derive certain conclusions relevant to central bankers and macroeconomists in general.

2 Preliminaries

The way an NGDP target is best thought of is to decompose it into components. First, should NGDP increase due to secular per capita growth? Second, should NGDP

¹ See Frankel (2012) for a literature review.

increase due to population growth? Third, should NGDP increase so as to allow for persistent price level inflation on average, and if so, by how much? A five percent NGDP target may correspond to a projected 1.5 % increase in RGDP per capita, a 1.5 % increase in population, and 2 % inflation. Under this scenario, when RGDP growth falls below its secular trend (e.g., via a supply shock), more inflation is introduced automatically into the system so nominal wages do not need to fall off trend. Conversely, when the economy is operating above what is believed to be its secular trend, inflation is reduced, possibly even resulting in deflation, to return the economy to its long run equilibrium in labor markets.

The above scenario corresponds to the type of NGDP target Sumner (2012) has endorsed. An alternative earlier proposal is Hayek's (1931) argument for a 0 % target (see Cachanosky 2014).² According to this point of view, deviations from the 0 % target (in either direction) subvert the price system in a non-neutral way, leading to unsustainable growth or needless unemployment. A third perspective may be thought of as a more extreme "Keynesian" perspective arguing for higher inflation targets than developed countries typically adopt.³ To simplify, a stylization of this corresponds roughly to a 10 % NGDP target. This distinction is summarized in Table 1.

The second concern is level targeting: whether the central bank should react to previous failures to achieve its target. This was first discussed in Taylor (1985), see also Hall and Mankiw 1994). The importance of the question in the context of the Great Recession has been discussed by Sumner (2011) and it would have significant policy implications. From 2010 to 2013, US NGDP has increased on average 3.8 % per year according to Bureau of Economic Analysis statistics. This rate of growth is below the median Market Monetarist position, but it is hardly disastrous (there are numerous similar years throughout the Great Moderation). However, the United States never returned to its trend NGDP and is falling further behind each year. The question then becomes when the US economy can put the collapse of NGDP in 2008–09 permanently behind it and shift to the long run vertical aggregate supply curve.

There are clear theoretical bases for each position on the optimal value of the target. But level targeting is more theoretically ambiguous. The question requires the consideration of the nature, meaning, and relative importance of price stickiness and debt contracts, as well as the short run/long run distinction. It is hoped that this paper's method will shed empirical light on the NGDP level target as well.

3 Method and data

Our method is to create a simple index of a country's central bank's recent record at achieving an NGDP target. This contrasts to other literature on NGDP targeting, which often focuses on the effectiveness of NGDP targeting relative to other policies (as in Guender 2007; Hendrickson 2012; Garin et al. 2015) or how it can be put into practice (as in Sumner 2015). However, methodologically, by fitting a simple model to data to investigate a prescriptive policy rule it is similar to Taylor (1993).

² See Selgin (1997) for a similar, though not identical target. See White (1999) for a summary of Hayek's perspectives on monetary policy.

³ For arguments to this effect, see Ball (2014) and Krugman (2014).

Table 1 Competing Hypothesis of the Optimal NGDP Target

“Hayek”	“Sumner”	“Keynesian”
0 %	5 %	10 %

We then measure its correlation with Okun’s Misery Index, the sum of inflation and unemployment rates. The rationale for this is, given the assumptions of Market Monetarism, the Misery Index should be highest when the central bank fails to adequately target the path of NGDP. This should eventually be observed in the outcome variables, i.e., inflation and unemployment. While we begin with the traditional equal weighting of inflation and unemployment, we will relax this assumption in our robustness checks by doubling the weight first on inflation and then on unemployment to test whether our results are sensitive to the implicit priorities of the Misery Index.

Our method is to numerically estimate two parameters which maximize the R^2 between the index of the central bank’s record at targeting NGDP with the Misery Index, subject to the constraint that the correlation coefficient R is positive. The second constraint ensures that high R^2 does indeed correspond to the relationship we are interested in rather than its opposite. These two parameters correspond to our two questions of interest. The first is how high the NGDP target should be set. The second is the extent of level targeting. Each parameter can give an answer which confirms one theory while rejecting the other, or the value it takes may end up being somewhere in between.

Let $NGDP_t$ denote NGDP in quarter t and $NGDP_t^*$ denote the value of Nominal Gross Domestic Product which the parameters dictate it should be if the central bank is operating optimally. Additionally, to give a sense of the central bank’s performance in the recent past (as opposed to a single quarter), we look at the root sum of squared deviations from $NGDP_t^*$ over J quarters. Looking at several quarters also allows for expectations to adjust to a new expected path of NGDP and to account for any long and variable lags, or concerns regarding reverse causality. The root sum of squared deviations is itself the index. In our estimations, J is set at eight quarters. Let φ_t denote the index, as in Eq. 1.

$$\varphi_t = \sqrt{\frac{\sum_{j=0}^{J-1} \left(\frac{NGDP_{t-j}^* - NGDP_{t-j-4}}{NGDP_{t-j-4}} - \frac{NGDP_{t-j} - NGDP_{t-j-4}}{NGDP_{t-j-4}} \right)^2}{J}} \tag{1}$$

$NGDP_t^*$ originates as the weighted average of several different level targets. It first looks back one year and calculates where NGDP would be if had hit the target. For instance, if the target (denoted as K) is a five percent growth rate and NGDP was 100.0 a year ago, NGDP should be 105.0 today. But the model then looks back another quarter (five quarters ago). If NGDP was at that point 99.0, then NGDP should be $99.0 \cdot (1.05^{5/4}) = 105.23$. To determine $NGDP_t^*$, it re-estimates the level target for S quarters and weights each in accordance with the parameter α . The weighting variable α can be thought of as somewhat analogous to a discount rate. When α is “large,” it

places all the weight on the most recent period. When α is “small” (bounded by -1), it places weight on the most distant period. In this manner α captures the extent of level targeting. Any value of α greater than -1 has a believable intuition. A value of -0.99 corresponds to placing all weight on the earliest period, a value of 0 equally weights all periods, and an arbitrarily “large” number places all weight on the most recent period.

Parameters K and α are our two parameters of interest. The formula for $NGDP_t^*$ is below as Eq. 2. Although it may not be readily apparent, Eq. 2 is a weighted average.⁴

$$NGDP_t^* = \frac{\sum_{i=0}^S \frac{NGDP_{t-4-i} * \left(1 + \frac{K}{100}\right)^{1+(\frac{i}{4})}}{(1 + \alpha)^i}}{\sum_{i=0}^S \frac{1}{(1 + \alpha)^i}} \tag{2}$$

With all this in hand, we reach our maximization problem (which we will solve numerically) in Eq. (3).

$$\begin{aligned} &\max_{\alpha, K} R^2(\varphi_t, \text{MiseryIndex}_t) \\ &s.t. \alpha > -1, R > 0 \end{aligned} \tag{3}$$

Calculating $NGDP_t^*$, necessitates a significant amount of data. Under the baseline estimation, φ_t requires two years of values of $NGDP_t^*$ and $NGDP_t^*$ requires five years (sixteen quarters of NGDP level targets starting four quarters ago and then working backwards). On the one hand, this rules out many countries for data reasons. On the other, using this starting point to some extent insulates the results from the objection that estimated optimal NGDP targets are contingent on inflationary expectations that are malleable in the long run. In fact, in our robustness checks, we allow the procedure to look back even further in the past.

The values the numerical maximization of this equation thereby inform our beliefs about the optimal size of the target and the importance of level targeting. As stated, the length of time considered using this method offers a means of allowing expectations to adjust in the long run; this at least in part addresses (though not fully) concerns about this method and the Lucas Critique. For instance, if the misery index would be minimized in the long run with zero growth in nominal output, this method would allow a significant lag for that to occur. However, if this period of time does not allow for expectations to adjust, there are other useful interpretations of the empirical exercise we are performing. One interpretation is that this methodology still allows for a test of to what degree any deviation from trend NGDP growth may lead to increases in the Misery Index. The presence of any relationship (or non-relationship) in the data may require explanations as well. While we abstract from the deep parameters that are

⁴ Each weight, bounded by zero and one, is:

$$\frac{1}{(1 + \alpha)^i} / \sum_{i=0}^S \frac{1}{(1 + \alpha)^i}$$

essential to having a complete theoretical understand or conducting a conclusive test, we still develop unique results that cannot be fully discounted.

Returning to the data, as a rule of thumb, any country that did not have at least one inflationary episode in sample or at least thirty-five years of data was ruled out. We do not believe this method will function reliably unless both one episode of an apparent demand shortfall and one episode of excessive inflation appears in-sample, for the general reason that more variance among observations reduces error. We identified the three pieces of quarterly data we required, inflation, unemployment, and NGDP, for seventeen countries. The only truly notable omission is Germany, due to the enormous ambiguities resulting from East and West Germany's reunification in the middle of the sample. We were left with a reasonable mix of countries. Importantly, a few of the countries, namely Mexico, Ireland, Taiwan, Spain, and Portugal, were not at the world technological frontier during at least some periods of our sample. This is of interest theoretically; if a country is able to sustainably grow its RGDP at 7 % for a number of years, the optimal NGDP target must be at least that high to avoid deflation.

Several different data sources were used to piece together quarterly data for the three variables of interest. These sources are summarized in Table 2 along with the years where all three variables have overlapping coverage. These sources are FRED, published by the Federal Reserve Bank of St. Louis, the United States Bureau of Labor Statistics, the IMF's International Finance Statistics, labor and unemployment statistics from the OECD, the Labor Market Statistics published by the UK's Office for National Statistics, and National Statistics of the Republic of China (Taiwan). The sample of countries is exhaustive of what data are available from these sources, subject to the condition mentioned above that the sample must apparently include at least one episode of a demand shortfall and one inflationary episode. Finally, descriptive statistics of

Table 2 Data Sources

Country	NGDP	Inflation	Unemployment	Year Coverage
United States	FRED	BLS	BLS	1953–2013
Canada	IFS	OECD	OECD	1970–2013
United Kingdom	IFS	OECD	LMS	1976–2013
Japan	IFS	OECD	OECD	1975–2013
Spain	IFS	OCED	FRED	1978–2012
France	IFS	OECD	FRED	1978–2012
Ireland	FRED	OECD	FRED	1982–2012
Austria	IFS	OECD	FRED	1976–2013
Portugal	IFS	OECD	OECD	1983–2013
Finland	IFS	OECD	OECD	1976–2012
Sweden	IFS	OECD	FRED	1986–2012
Norway	IFS	OECD	FRED	1976–2012
Australia	IFS	OECD	OECD	1976–2013
Netherlands	IFS	OECD	FRED	1983–2012
Switzerland	IFS	OECD	FRED	1981–2011
Taiwan	NS-ROC	NS-ROC	NS-ROC	1987–2014

year-to-year NGDP growth rates, inflation, and unemployment by country are provided in Tables 3, 4 and 5.

4 Results

Broadly speaking, most results conform to a 5 % NGDP Target, as shown in Table 6.⁵ Those in the sample range from an NGDP target in the Netherlands of 2.70 to 20.94 in Austria. All except Austria fall within the interval two to eight. The differences between the countries do not follow any obvious pattern, and any extrapolation from such a small sample is hazardous. The two extremes of the Netherlands and Austria have very low R^2 ; it is likely it is an indication that the model is weak and perhaps meaningless in those cases. In such cases, factors other than aggregate demand management dominate the variation in the Misery Index over time to such a degree that no relationship is readily apparent. Conversely, it may limn the limits of the Market Monetarist model, though there are several examples of sensible results with high R^2 to be found in Table 6. It is worth noting that three of the five countries most distant from the technological frontier – also the three of the five with the highest R^2 – Spain, Portugal, and Taiwan, have the three highest NGDP targets among all seventeen countries.

The absence of countries with a calculated optimal NGDP target close to zero offers evidence against the “Hayekian” policy rule. That Japan has such a low target following two decades of virtually zero price level inflation is perhaps demonstrative of eventual adjustments to inflationary expectations, but it may instead reflect its rapidly aging population or the luck of a draw in a small sample. The result for the Netherlands has such a low R^2 that it is inappropriate to see it as indicative of anything. Overall, for advanced economies, a starting point of a five percent NGDP target is clearly supported by the data. The results also do not reject increasing the NGDP target further in countries with higher secular growth rates, which coheres with the earlier explanation that the target may be viewed as the targeted sum of RDGP and some level of inflation. The results do not either reject the Keynesian argument for still higher rates of inflation, but they are less supported than the Market Monetarist (Sumner) position, as described in Table 1.

The results of the α parameter were actually genuinely surprising. We expected that α would not generally take values less than zero, as we believed the optimal weighting would always weight the most recent period the most highly. Instead, these results support a strong version of level targeting. For countries with a negative value, greater weight should be placed on the earlier periods. In fact, for the many countries with an α calculated to be -0.99 , this is in practice a corner solution placing all weight on the earliest period. This implies these countries would best minimize their Misery Index over time by ignoring recent changes

⁵ Included in Table 6 and subsequent tables are results regarding the slope coefficients. These are included to allow for a complete picture of the modeling results, but comparisons across countries are not readily apparent, as the variation amongst them is driven largely by the variation in the K and α parameters.

Table 3 Descriptive Statistics – NGDP Year-Over-Year Growth Rates (%) by Country

Country	Mean	s.d.	min	max
United States	6.66	3.56	-3.68	19.55
Canada	7.71	4.54	-7.30	20.94
United Kingdom	8.48	5.59	-5.12	29.18
Japan	4.63	5.91	-8.81	23.18
Spain	10.40	6.92	-4.57	27.64
France	6.97	5.08	-2.94	19.46
Ireland	10.73	7.89	-10.93	29.66
Austria	5.91	3.78	-5.07	20.09
Portugal	11.33	9.42	-4.07	33.00
Finland	8.00	6.88	-8.77	31.77
Sweden	5.97	3.78	-4.05	15.42
Norway	8.99	6.33	-10.10	30.78
Australia	9.07	4.60	-1.23	23.75
Netherland	4.37	2.69	-4.27	13.84
Switzerland	3.98	3.54	-3.62	20.11
Taiwan	6.83	5.06	-8.59	20.04

and actively target based on the path dictated from five years ago (as in the model, one year back followed by sixteen quarters back).

Table 4 Descriptive Statistics – Inflation Rates by Country

Country	Mean	s.d.	min	max
United States	3.69	2.89	-2.10	14.70
Canada	4.29	3.32	-0.90	12.70
United Kingdom	5.93	5.53	0.60	26.60
Japan	2.82	4.60	-2.20	23.40
Spain	6.30	5.00	-1.10	23.50
France	3.91	3.80	-0.40	14.10
Ireland	3.70	3.71	-6.10	21.00
Austria	3.48	2.20	0.00	10.00
Portugal	6.81	7.01	-1.50	30.60
Finland	5.18	4.63	-1.00	18.50
Sweden	5.15	4.00	-1.40	14.70
Norway	4.96	3.59	-1.40	14.60
Australia	5.65	4.08	-0.40	17.70
Netherland	3.52	2.67	-1.20	10.90
Switzerland	2.19	1.99	-1.00	8.50
Taiwan	1.71	1.71	-1.34	5.96

Table 5 Descriptive Statistics – Unemployment Rates by Country

Country	Mean	s.d.	min	max
United States	5.90	1.63	2.60	10.40
Canada	8.09	1.76	4.90	12.90
United Kingdom	7.19	2.36	3.40	11.90
Japan	3.11	1.25	1.10	5.40
Spain	14.54	4.44	5.40	23.80
France	8.83	1.50	4.50	11.30
Ireland	10.87	4.80	3.70	17.00
Austria	5.04	2.07	1.46	7.92
Portugal	7.88	3.18	3.90	17.50
Finland	7.50	3.71	2.10	17.60
Sweden	4.80	2.80	1.40	10.30
Norway	3.38	1.49	1.20	6.70
Australia	6.33	2.25	1.60	11.10
Netherlands	4.90	1.73	0.90	8.40
Switzerland	2.15	1.51	0.10	4.60
Taiwan	3.15	1.32	1.30	6.08

Table 6 Baseline Results

Country	K	α	R^2	<i>Slope</i>
United States	5.64	-0.08	0.65	53.52
Canada	3.77	-0.99	0.62	27.10
United Kingdom	5.04	-0.99	0.79	26.36
Japan	2.81	-0.12	0.55	16.08
Spain	7.45	-0.99	0.52	20.71
France	4.84	-0.14	0.75	22.82
Ireland	4.54	-0.99	0.11	15.76
Austria	20.94	-0.99	0.10	1.78
Portugal	7.77	*	0.79	123.86
Finland	6.90	-0.07	0.41	27.82
Sweden	5.58	*	0.16	46.90
Norway	6.99	-0.99	0.44	15.46
Australia	6.93	-0.02	0.73	45.12
Netherlands	2.70	-0.99	0.01	3.68
Switzerland	4.19	0.52	0.20	36.32
Mexico	4.67	-0.99	0.27	12.54
Taiwan	7.92	-0.32	0.17	15.41

*Denotes very large number that should be interpreted as a corner solution in α . In K , the model has failed to find a maximum at a “reasonable” value

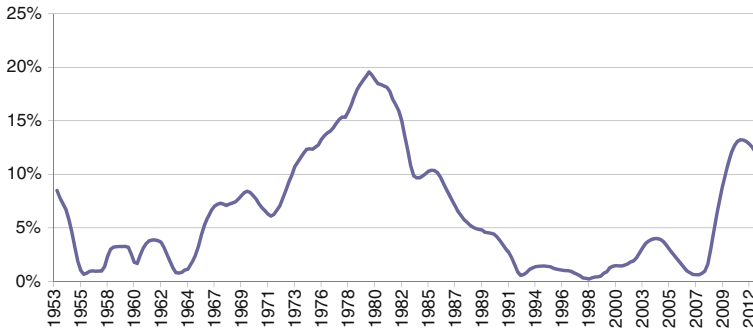


Fig. 1. Index applied to the United States

Portugal and Sweden, however, are the exceptions. Their alphas are calculated to be very “large” (2982.7 and 27.8), both of which in practice mean to only consider the most recent period. In our results tables, we have starred out (*) any “large” estimation to avoid confusion over its interpretation.⁶ These results reject the usefulness of level targeting for these countries.

There is some additional economic interpretation to the value of the R^2 between the Misery Index and our index. We should expect high R^2 in countries whose Misery Indexes are dominated more by demand side factors and who have had steady secular growth rates. The countries with R^2 less than 0.20 are Ireland, Sweden, Austria, the Netherlands, and Taiwan. Taiwan and Ireland may have had rapidly changing secular growth rates and it is not a controversial claim that supply side reforms and shocks in Sweden, Austria, and the Netherlands may have had greater impacts on their economies than failures in their aggregate demand management.

Countries with high R^2 can be thought of as those who would have had the most to gain with better aggregate demand management, conceived of through the NGDP targeting lens. The countries with an R^2 of at least 0.70 are the United Kingdom, Portugal, France, and Australia. Little obvious connects these countries. However, the data suggest that these countries would have historically accrued the most benefits in engaging in this policy and where a constant parameterization is most appropriate.

Another way of looking at the results is to graph the index over time. This has been done for the United States in Fig. 1, an example of a country where the index performs well. Fig. 2 applies the index to Portugal and Fig. 3 applies it to Taiwan. While visually these figures may appear to offer strong evidence in favor of Market Monetarism, we do not argue as such and do not believe that, for instance, this metric applied to the United States would perform out of sample as well as the R^2 suggests. While the R^2 calculated may accurately reflect the relative importance of aggregate demand management as measured by NGDP across countries, R^2 literally is the variable maximized in-sample. The purpose of this empirical exercise is to see which hypothesis most closely matches the data. These three figures may be of interest nonetheless and it may be possible to use a method similar to this to evaluate aggregate demand management out of sample.

⁶ This was done for all alphas calculated to be 10.0 or greater.

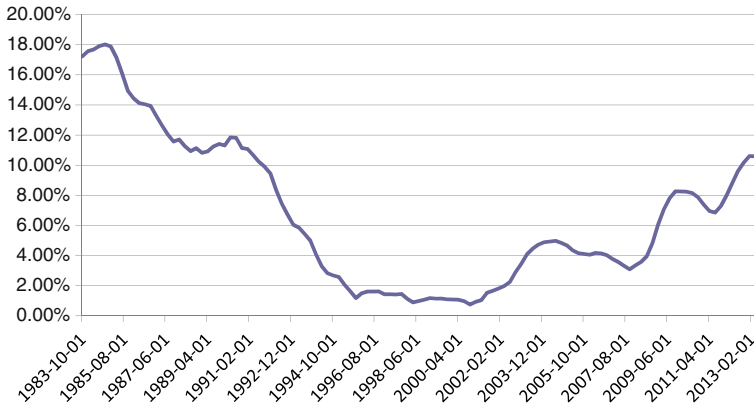


Fig. 2. Index applied to Portugal

5 Robustness checks

The robustness checks performed lead us to be somewhat circumspect about our results. Not all of the initial results appear robust. That is an interesting empirical finding, perhaps a challenge, to the Market Monetarist model. That is, if the optimal NGDP target or the optimal extent of level targeting is sensitive to how the index is constructed, it raises questions as to how straightforward it is to develop a policy function for each country's central bank.

The first robustness check is to have the index consider 12 or 20 quarters of data instead of 16. These results are found in Tables 7 and 8. When this is performed, the optimal NGDP targets actually change very little, which is reassuring. After omitting countries with an R^2 less than 0.20, the average of all NGDP targets rises from 5.77 using 16 quarters to 5.91 using 12 quarters and to 5.92 using twenty quarters. Among the countries for which the model had an R^2 of at least 0.20, the greatest change is Canada's K rising from 3.77 in the baseline to 5.30 with 12 quarters and 5.41 with twenty quarters. It should also be noted that the model ceases to perform well in certain countries depending on the window used, for instance Sweden when a window of 12 quarters is used, and that the K values for the Netherlands are no longer at the fringe of reasonable in the robustness checks (and have therefore been starred out). Still, for most countries, the K parameter is well behaved regardless of the window used.

However, the α parameter (level targeting) is a bit more suspect. The United States, Japan, and Finland shift from a corner solution to deeply into the interior depending on the time frame used. This, in conjunction with the general unpredictability of the α parameter across countries, raises doubts regarding whether we can really be confident about level targeting one way or the other. Contrary to the strong positions taken regarding the relative importance of level targeting, the data simply do not support strong beliefs, and its sensitivity to rather small changes in time frame are disturbing.

The second robustness check adjusts the weights on the Misery Index.⁷ Instead of an equal weighting, it first doubles the weight on inflation. Secondly, it instead doubles the

⁷ In some ways this is to ensure the index is robust against the concerns of Di Tella et al. (2001))

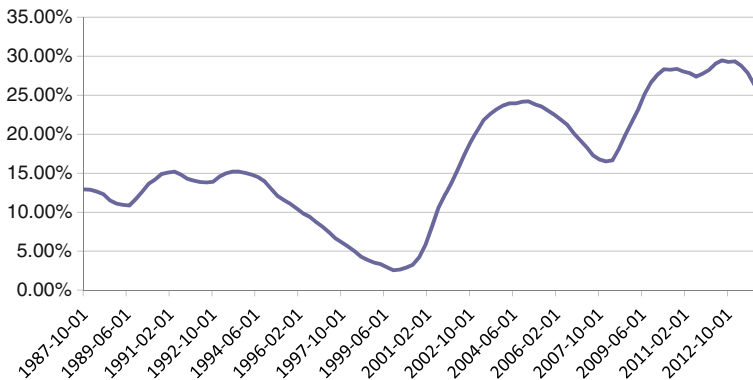


Fig. 3. Index applied to Taiwan

weight on unemployment. These results can be found in Tables 9 and 10. They conform to theory, as the average calculated K falls to 4.66 when inflation is double weighted and rises to 7.70 when unemployment is double weighted. This supports in some sense the existence of a permanent inflation-unemployment tradeoff. Additionally, the average R^2 is 0.53 with inflation double weighted, in comparison to 0.43 in the baseline specification and 0.41 with unemployment double weighted, supporting the belief that monetary policy has greater control over rates of inflation than it has in dictating

Table 7 Results Using 12 Quarter Window

Country	K	α	R^2	<i>Slope</i>
United States	5.94	-0.99	0.68	67.21
Canada	5.30	-0.99	0.61	26.07
United Kingdom	4.79	-0.99	0.74	30.23
Japan	2.80	-0.31	0.66	16.55
Spain	7.59	-0.99	0.49	23.15
France	4.81	-0.62	0.76	21.77
Ireland	3.43	-0.99	0.09	16.30
Austria	10.58	-0.90	0.06	2.65
Portugal	7.72	*	0.80	31.91
Finland	6.68	-0.99	0.50	22.78
Sweden	15.70	-0.99	0.00	0.33
Norway	7.02	-0.99	0.38	18.07
Australia	6.82	-0.35	0.74	36.48
Netherlands	1.91	-0.99	0.01	3.98
Switzerland	4.20	-0.99	0.22	7.66
Mexico	5.86	-0.99	0.21	12.17
Taiwan	8.04	-0.94	0.18	7.20

*Denotes very large number that should be interpreted as a corner solution in α . In K , the model has failed to find a maximum at a “reasonable” value

Table 8 Results Using 20 Quarter Window

Country	K	α	R^2	<i>Slope</i>
United States	5.90	-0.04	0.79	68.06
Canada	5.41	-0.99	0.61	19.13
United Kingdom	5.24	-0.99	0.81	23.16
Japan	2.96	-0.99	0.42	7.84
Spain	7.42	-0.99	0.55	18.53
France	4.85	0.01	0.74	25.31
Ireland	9.92	-0.99	0.16	15.64
Austria	36.73	-0.99	0.12	0.74
Portugal	7.82	*	0.82	103.17
Finland	7.14	0.02	0.34	12.91
Sweden	5.07	*	0.20	49.80
Norway	6.70	-0.99	0.48	13.38
Australia	7.05	0.09	0.71	22.86
Netherlands	*	8.19	0.01	0.001
Switzerland	4.09	0.59	0.18	52.62
Mexico	5.02	-0.99	0.25	12.61
Taiwan	7.54	-0.11	0.17	5.19

*Denotes very large number that should be interpreted as a corner solution in α . In K , the model has failed to find a maximum at a “reasonable” value

employment levels. In α , Austria, Norway, and the Netherlands swing from corner solutions to strongly interior solutions, although in general α behaves better under this series of robustness checks than in the first series.

6 Conclusion

This paper finds some evidence in favor of an NGDP target of around 5 %. However, the relationship is not especially tight and deviations from the optimal target do not always explain very much of the variation of unemployment and inflation within every country. The model undeniably fails as applied to a subset of the countries investigated, namely Austria, Sweden, and especially the Netherlands. Additionally, as operationalized in this paper, it is wholly unclear whether level targeting is appropriate. Countries vary drastically in this regard and may change drastically and unpredictably, depending on the construction of the index. It is not out of the question that an alternative operationalization of level targeting – the one used in this index is one way among many, done in part for the preference of minimizing the number of parameters – but the erratic behavior found here is still disconcerting. Such operationalizations and formalizations may shed more light on some of the difficulties found here. Procedures similar to that found in this paper may be extended to other monetary rules in future research as well.

Table 9 Results Using Double Weight on Inflation

Country	K	α	R^2	$Slope$
United States	4.56	0.05	0.64	106.36
Canada	3.50	-0.99	0.72	52.78
United Kingdom	4.99	-0.99	0.83	49.14
Japan	1.30	-0.06	0.62	33.05
Spain	6.76	-0.99	0.81	44.38
France	4.59	-0.09	0.83	55.81
Ireland	3.72	-0.99	0.29	36.73
Austria	3.87	-0.74	0.16	10.19
Portugal	5.86	*	0.78	204.88
Finland	4.65	0.08	0.70	73.27
Sweden	3.61	1.00	0.40	133.31
Norway	6.34	-0.99	0.59	34.81
Australia	6.62	0.02	0.78	88.23
Netherlands	-19.26	-0.99	0.01	29.31
Switzerland	3.06	0.15	0.40	59.70
Mexico	5.64	-0.99	0.30	25.82
Taiwan	6.11	-0.99	0.13	17.21

*Denotes very large number that should be interpreted as a corner solution in α . In K , the model has failed to find a maximum at a "reasonable" value

Table 10 Results Using Double Weight on Unemployment

Country	K	α	R^2	$Slope$
United States	5.99	-0.11	0.65	74.70
Canada	4.12	-0.99	0.39	28.55
United Kingdom	5.07	-0.99	0.62	29.95
Japan	4.53	-0.05	0.59	18.27
Spain	7.63	-0.99	0.14	17.39
France	5.71	-0.16	0.35	16.18
Ireland	11.10	-0.99	0.11	22.11
Austria	13.87	-0.99	0.59	11.84
Portugal	10.36	*	0.82	204.90
Finland	9.27	-0.16	0.39	36.33
Sweden	9.88	0.44	0.41	73.65
Norway	8.57	-0.41	0.15	14.38
Australia	7.29	0.01	0.54	57.41
Netherlands	*	15.17	0.06	0.01
Switzerland	5.80	0.44	0.26	47.74
Mexico	7.15	-0.99	0.20	10.62
Taiwan	11.01	0.02	0.63	15.41

*Denotes very large number that should be interpreted as a corner solution in α . In K , the model has failed to find a maximum at a "reasonable" value

Even if this method is unconvincing in its ability to fully address the long run effects of adjusting expectations, the level of fit in many countries is suggestive of the importance (or the relative importance, across countries) of a given NGDP target in explaining inflation and unemployment over time. Why R^2 differs so greatly across countries or why results for level targeting are not robust are themselves interesting questions without obvious answers. We hope they are answered in the future.

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