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ABSTRACT

Fixing Swiss Potholes: The Importance of Improvements

The objective of this note is to document the importance of improvements relative to the other forms of capital spending and to determine whether improvements have similar cyclical properties as maintenance and repair. To shed some light on these issues, we look at a unique data set on Swiss road spending. The data on road spending are broken down into new roads, road improvements, and road maintenance and repair (hereafter road maintenance). The long-run evidence finds that road improvement is larger in size than road maintenance and exhibits similar dynamic properties as road maintenance. This result strengthens the view of McGratten and Schmitz (1999) that countercyclical spending of firms on maintenance (and on improvement) of existing capital is too large to be ignored.

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1. Introduction

Recent studies by McGratten and Schmitz (1999), Collard and Kollintzas (2000), and Licandro and Puch (2000) introduce *maintenance* and *repair* as a separate factor of capital utilization. This distinction between maintenance and repair and investment in new physical capital is one way to introduce time-varying depreciation and is able to capture important dynamics of the U.S. labor market.[1] These two forms of capital spending are assumed to have distinct dynamic properties. So far, the empirical evidence supporting the view that maintenance and repair is countercyclical to GDP is limited. The only empirical study is by McGratten and Schmitz (1999). They show that investments in new physical capital is procyclical over the Canadian business cycle, while maintenance and repair is countercyclical. The rationale for maintenance's countercyclical behavior is that it is cheaper for the firm to repair and maintain machines when they are not running than when they are in use.

In addition to firm spending on maintenance and repair and on new physi-

[1]See also Ambler and Paquet (1994), Burnside, Eichenbaum and Rebelo (1992, 1996) and King and Rebelo (2000) for related research.

cal capital, firms also have capital outlays for *improvements*. Such spending activities expand the functions or capabilities of existing physical capital. Examples include the addition of a lane or rest stops on an existing highway or the introduction of new filters in engines to improve air or water quality. A priori it is not clear how improvements should behave over the business cycle. On the one hand, improvements may increase the utilization of a machine and expand production during an economic upswing. On the other hand, improvements, as in the case of maintenance and repair, require brief periods of shutdown to carry out the upgrades. This can be implemented most cost effectively during periods of economic slowdown.

The objective of this note is to document the importance of improvements relative to the other forms of capital spending and to determine whether improvements have similar cyclical properties as maintenance and repair. To shed some light on these issues, we look at a unique data set on Swiss road spending. The data on road spending are broken down into new roads, road improvements, and road maintenance and repair (hereafter road maintenance). The long-run evidence finds that road improvement is larger in size than road maintenance and exhibits similar dynamic properties as road maintenance. This result strengthens the view of McGratten and Schmitz

(1999) that countercyclical spending of firms on maintenance (and on improvement) of existing capital is too large to be ignored.

2. Maintenance, Improvements, and Investment in Roads

The annual data on Swiss road costs is taken from the Bundesamt für Statistik (BfS) and covers the period from 1927 to 1984.[2] Spending on national and cantonal roads is divided between road maintenance, road improvement and new roads. Table 1 shows that our measure of road spending averaged 1.6% of GDP during 1963-1984 compared to 5.8% for education and 2.8% for research and development for the same period. The addition of local roads, a component not included in our road measure, would have increased the percentage to 2.2%.

To gain a sense of the size of road improvements relative to other road outlays, Figure 1 plots the ratio of road maintenance and road improvement to new road investment from 1927 to 1984. The figure reveals that spending on road improvements is just as large if not larger in size than road mainte-

[2]The publication of this information was discontinued after 1984. The data for improvements and maintenance were not published separately before 1927.

nance. If averaged figures are considered than road improvements is always larger in size than road maintenance. Table 2 shows that the ratio of road improvements to new roads is 4.9, whereas it is only 3.8 for road maintenance over the full sample. This result holds for various subperiods.

Another feature of Figure 1 is the time-varying ratio of improvements and maintenance to new roads. During the first 20 years (1927-1947) of the sample, road improvements and road maintenance are considerably larger than new road investment. In the second half of the sample from 1948-1984, the ratio reverses for new road spending increases substantially due to several large tunnel projects beginning in the 1960s. This reversal in new roads' importance is highlighted further in Table 2. The ratio of road spending to current GDP shows that new roads made up only 0.02% of GDP in the period 1927-1947, but increased to 0.71% for the period 1948-1984.[3]

Next, to examine business cycle movements in Swiss GDP and road spending, we detrend each series (all in current Swiss francs) by taking logs and subtracting the trend using the Hodrick-Prescott filter to obtain our measure of volatility.[4] Figure 2 displays the filtered data. Although the

[3]The official BfS series for nominal GDP (1948-1984) has been linked with the estimated series from Andrist *et al.* (2000).

[4]The weight on the squared 2nd difference of the growth component in the H-P filter

long-run series reveal changing dynamics, some remarks can be made with the help of the statistics presented in Table 3.

The first observation regards the low volatility of road maintenence. Table 3 shows the relative standard deviation of the different forms of road spending to GDP. Road maintenance always has the lowest volatility, followed by road improvement and new road investment. The second observation concerns the cyclical behavior of Swiss road spending. The correlation of new road investment and nominal GDP is always positive. This procyclical result is true for the more volatile 1927-1947 period (i.e. correlation is 0.99) as for the post-War 1948-1984 period (0.36). On the other hand, the correlation of maintenance and improvements tends to be negative. The long-run correlation is zero and only for the post-War period do we find the two forms of spending to be countercyclical with GDP.

3. Some General Remarks

The long-run data on Swiss road financing also allow us to make some comparative statements concerning the findings of the Canadian survey data

was set to 100.

documented in McGratten and Schmitz (1999). First, Swiss road maintenance exhibits similar countercyclical characteristics as those found for the Canadian data. Second, the Swiss data on road maintenance and on road improvement as a percentage of spending on new roads varies substantially over time. McGratten and Schmitz (1999) find that the ratio of maintenance and repair to new physical capital is trendless for the post-1960 period. Our long-run data shows that this is only true for the period considered in McGratten and Schmitz (1999). Prior to 1960, Swiss road improvement and road maintenance was much larger in size than new road spending.

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Table 1: Type of Activity as a % of Switzerland's GDP (1963-1984)

Public Road Spending (national, cantional, and local roads)	2.2%
National and Cantonal Road Spending	1.6%
Education	5.8%
Research and Development	2.8%

Table 2: Relative Size of Road Spending

	1927-1984	1927-1947	1948-1984	1963-1984
improvements/ new roads	4.87	7.85	3.18	0.33
maintenance/ new roads	3.80	6.70	2.15	0.24
improvements / GDP	0.32%	0.15%	0.42%	0.36%
maintenance / GDP	0.22%	0.13%	0.26%	0.25%
new roads / GDP	0.46%	0.02%	0.71%	1.07%

Table 3: Correlation and Volatility Measures with Output

	$Correlations$(Road Spending, GDP)			$\sigma_{spending}/\sigma_{GDP}$		
	1927-1984	1927-1947	1948-1984	1927-1984	1927-1947	1948-1984
improvements	0.83	0.99	0.36	1.24	1.02	3.65
maintenance	-0.02	0.02	-0.34	0.97	0.88	1.99
new roads	-0.01	-0.11	-0.30	0.30	0.21	1.10

Notes: $Correlations$(Road Spending, GDP) is the correlation between the different forms of road spending and nominal GDP. $\sigma_{spending}/\sigma_{GDP}$ is the ratio of the standard deviations for road spending and nominal GDP.

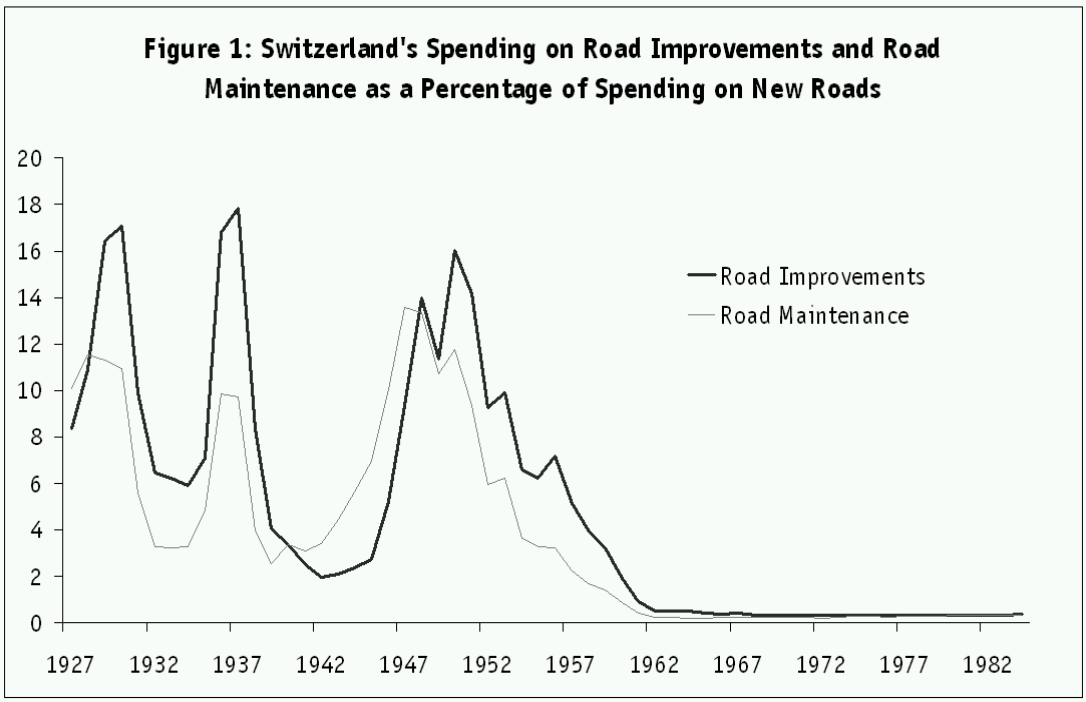
Figure 1: Switzerland's Spending on Road Improvements and Road Maintenance as a Percentage of Spending on New Roads
20
18
16
14
12
10
8
6
4
2
0
1927
1932
1937
1942
1947
1952
1957
1962
1967
1972
1977
1982
Road Improvements
Road Maintenance

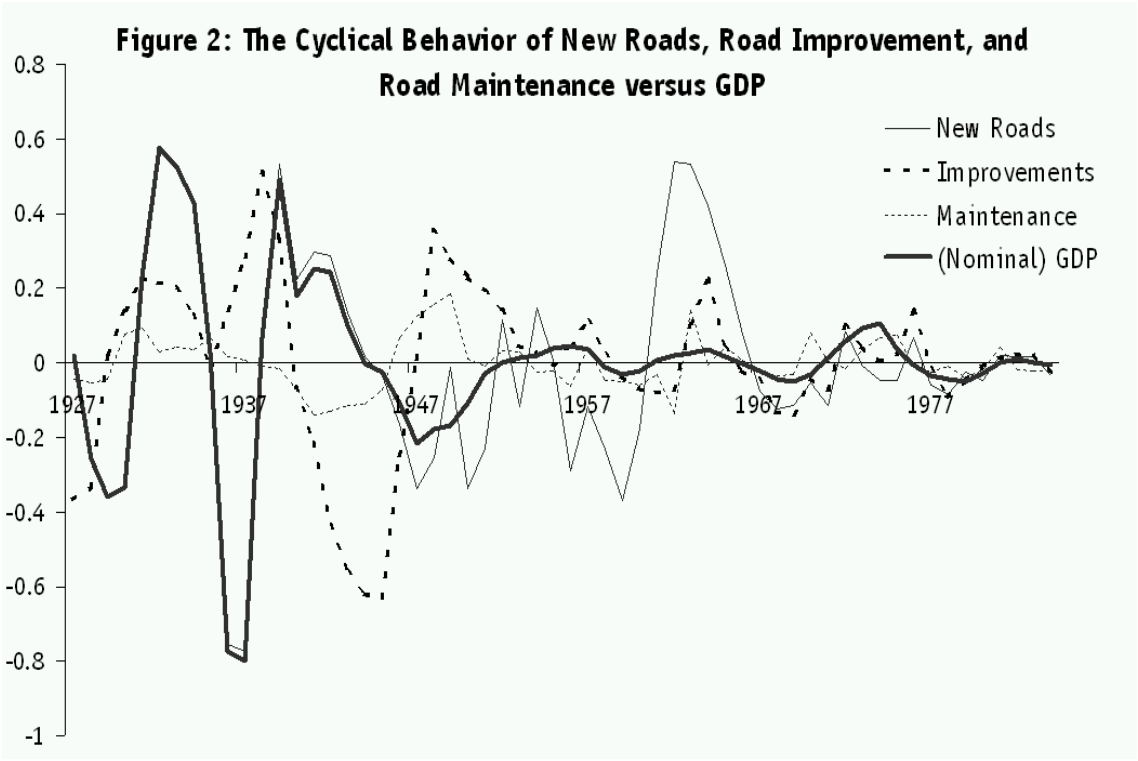
Figure 2: The Cyclical Behavior of New Roads, Road Improvement, and Road Maintenance versus GDP
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
1927
1937
1947
1957
1967
1977
New Roads
Improvements
Maintenance
(Nominal) GDP