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Fiscal Consolidations and Growth: Does Speed Matter?

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Abstract

Should fiscal consolidations be front-loaded or proceed at a more steady pace, and how does this affect growth? We make an attempt to address this question using a three-step methodology. First, we modify a standard regression of growth on consolidation size to allow speed to affect the multiplier. Second, using the narrative dataset of Devries and others (2011), we construct a new sample of multi-year consolidation episodes for 17 advanced economies over 1978-2009. Third, we develop a novel concept of speed to measure the pace of the consolidation episodes identified in the data. The main empirical finding is that fast episodes have higher multipliers than gradual consolidations. This provides some preliminary support for consolidating at a steady pace, market access and a credible adjustment plan permitting. However, as the sample size is small, identifying mechanisms and testing robustness is difficult, and so our findings should not be interpreted causally.

JEL Classification Numbers: E32, E62, E61, H20, H5, H60, E1

Keywords: Fiscal policy, fiscal multipliers, government expenditure, anticipation effects

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Contents

I. INTRODUCTION[2]

This paper explores whether the speed of fiscal adjustment can improve our understanding of fiscal multipliers. The empirical question at stake is, for a given size of fiscal retrenchment, does it matter to proceed hastily versus more deliberately? In other words, once the overall consolidation needs have been pinned down, should the pace of fiscal consolidation be an additional concern? Specifically, is it the case that fast consolidations display higher multipliers as opposed to slow episodes?

There are a number of reasons why the multiplier may vary with speed. In particular, we point out cyclical asymmetries, composition and anticipation effects as potential explanations. Inspired by these motives, we primarily aim for an empirical contribution which provides new, preliminary evidence on how variations in speed affect the multiplier.

To this aim, we depart from the empirical literature on multipliers in three ways. First, we augment an otherwise standard multiplier regression of growth on consolidation size with the interaction between speed and consolidation size. Second, we construct a new sample of multi-year consolidation episodes using the narrative dataset of Devries and others (2011). Third, we develop a new index to measure the speed of the consolidation *episodes* identified in the data.

Our findings suggest that, historically, fast consolidations had higher multipliers than more measured adjustments. Results on robustness are mixed and should, therefore, be interpreted with caution. The core findings are not affected by, e.g., alternative identification strategies for the consolidation *episodes* and the GDP growth trend. However, robustness to additional controls, in particular the consolidation length, is impaired by the small sample size. Also, because speed of the episodes may not be exogenous, our results should not be interpreted causally.

Our results provide some preliminary support for consolidating at a steady pace, rather than upfront, because slower consolidations are often associated with lower multipliers. Despite this, some front loading may be inevitable where market access is fragile or when medium-term adjustment plans lack the credibility to sustain gradual fiscal consolidations over time.

The rest of the paper is organized as follows. Section II discusses a number of reasons why speed may have a bearing on the multiplier. Section III focuses on the methodology and presents the main characteristics of the sample used for regression purposes. Section IV

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reports how variations in speed affect the multiplier in the data. Section V conducts a number of robustness tests. Section VI concludes.

II. WHY SPEED MAY MATTER?

This section briefly looks at the literature on fiscal multipliers through the lens of speed and collects a number of arguments rationalizing why the pace of fiscal consolidation may matter to multipliers. Composition, cyclical asymmetries and anticipation effects may vary with speed, ultimately affecting the multipliers. We discuss each one in turn.

Composition effects. If speed determined where governments will cut, speed would be the *ultimate* driver of the multiplier while the composition of fiscal adjustment would be the *apparent* cause. Specifically, if fast consolidations were to target budgetary lines with relatively high multipliers, rather than aiming for wasteful areas of spending, they could be more damaging to growth than more gradual retrenchments. For example, pension reforms typically take long to negotiate and implement, but may have a lower impact on growth than, say, cutting back on public investment. More generally, all other things being equal, spending multipliers tend to exceed those on revenues, as tax cuts may be leaked to savings; within revenues, multipliers for income taxes tend to be larger than for indirect taxation (OECD, 2009).[3] Relatedly, Ramey and Shapiro (1998) argue that changes in government spending are often concentrated in a narrow range of sectors (such as defense equipment manufacturing). In the presence of frictions that impede the flow of capital and labor away from these sectors, slower cuts will tend to have lower multipliers.

Asymmetric multipliers. An emerging strand of the literature finds that the effects of fiscal policy on growth are non-linear, with multipliers in recessions being larger than in upturns (Auerbach and Gorodnichenko, 2012; Batini and others, 2012; Baum and others, 2012). By this logic, spreading consolidation over several years can help to prevent the economy from dipping into recession, where multipliers are higher. This raises the deeper question of where these asymmetries might come from. Schmitt-Grohe and Uribe (2010), for example, demonstrate that downwardly rigid nominal wages can lead to large asymmetries in the face of shocks. In this vein, a negative fiscal shock could well exacerbate the adjustment in quantities and increase the size of the multiplier. A broader literature has outlined a number of mechanisms which may *amplify* the impact of shocks on output during downturns, such as: (i) lower crowding out effects, as a larger share of labor and capital services remains idle during downturns (Hall, 2009); (ii) extensive deleveraging and tighter credit constraints (Curdia and Woodford, 2009; Canzoneri and others, 2011) and (iii) a fixed exchange rate and/or less scope for monetary policy to counter the fiscal contraction (see, e.g., Anderson and others, 2012).

[3] Testing this hypothesis empirically needs data on line items, which are unavailable in our sample.

Anticipation effects. In standard new Keynesian DSGE models, the size of the multiplier varies with the speed of fiscal consolidation (see Appendix for technical details). This is because households fully anticipate a higher permanent income from credible fiscal consolidations (thus lower future taxes), raising current consumption in response. Gradual consolidation profiles imply some increase in consumption before the bulk of the spending actually occurs, which reduces the short run multiplier. More generally, anticipation effects can also operate through interest rates when the monetary authority cuts policy rates in response to a credible multi-year consolidation. A creditable announcement of retrenchment measures could also lead to a depreciation of the exchange rate and boost exports before the bulk of the consolidation actually occurs, lowering the short-term multiplier.[4]

III. METHODOLOGY

The methodology involves three steps. The first step is to specify a simple reduced-form multiplier equation that considers both consolidation size and consolidation speed. The second step is to identify consolidation *episodes* in the data. The third step involves defining a novel concept of speed, which is used to measure the speed of the consolidation packages included in our sample.

A. A Speed-Augmented Multiplier Regression

The speed-augmented equation adds an interaction term to an otherwise standard multiplier regression of growth on consolidation size (equation *E1*). The multiplier is measured as the negative of the partial derivative of growth with respect to the consolidation size (equation *E2*).

$$Growth = \alpha + \beta\, Size + \gamma[Size \times Speed] + \varphi\, Speed \qquad (E1)$$

$$Multiplier \equiv -\frac{\partial Growth}{\partial Size} = -[\beta + \gamma Speed] \qquad (E2)$$

In standard multiplier analysis, the multiplier is given by $-\beta$.[5] The novelty here is to consider that the multiplier may vary with speed (if $\gamma \neq 0$). Specifically, in light of the discussion in Section II our prior is that the output damage of gradual consolidations may be less than for more front-loaded profiles ($\gamma < 0$).

Growth, size and speed in equations *(E1)* and *(E2)* are measured as follows:

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[4] Given the cross-sectional nature of consolidation *episodes*, this mechanism is, however, difficult to test in our sample.

[5] As standard in the literature, consolidation size is given a positive sign for a cut in spending.

- Growth is a *flow*[6] computed as the average annual deviation from trend GDP growth over the consolidation period. The multiplier is computed as the average *flow* of output relative to savings over the length of the consolidation. This slightly differs from the standard cumulative multiplier used in the literature, which measures the change in the output and the deficit in *levels* after a fixed number of years.[7] The *flow-based* approach is more suitable for the purpose of this study, given that the length of the consolidation widely varies across episodes. Moreover, consumers care about flows rather than levels, especially if a benign GDP level at the end of a consolidation were to mask a deep recession in the intervening years. Algebraically

$$Growth^{c}_{t+1,t+N} = \frac{1}{N}\sum_{i=1}^{N}[Y_{t+i} - Y^{trend}_{t+i}] = \frac{1}{N}\sum_{i=1}^{N}[\prod_{j=1}^{i}\left(1+g_{c,t+j}-\bar{g}_{c}\right) -1] \qquad (E3)$$

where Y is natural log of real GDP, $g_{c,t+i}$ is growth in country c in year $t+i$, $\bar{g}_c$ is the country-specific average growth rate, and N is the length of the consolidation episode.

- For the episodes delineated in Section II.B, size is measured as the average annual savings from the program as a percent of GDP. It is given by

$$Size^{\,c}_{t+1,\,t+N} = \frac{1}{N}\sum_{j=1}^{N}\left[savings_{t+j}\right] = \frac{1}{N}\sum_{j=1}^{N}\left[surplus_{t+j} - surplus^{baseline}_{t+j}\right] = \frac{1}{N}\sum_{i=1}^{N}\sum_{j=1}^{i}\Delta surplus_{t+j} \qquad (E4)$$

where *surplus* is the budget surplus as a share of GDP

- Speed is measured as described in Section II.C.

[6] Using the change in log GDP over the whole consolidation period would be inappropriate, as a benign change in the log level GDP over several years may mask a recession in the intervening years. We use savings-to-the budget as measure of consolidation size to be consistent with the flow-based measure of growth.

[7] The flow and standard multipliers are not directly comparable. If consolidation only effects output contemporaneously, then flow-based multipliers will be the same as standard, levels-based multipliers; but they can differ with more sophisticated dynamics. To illustrate, the multipliers in Guajardo and others (2011) rise in the second year, but fall in the third. By implication, flow-based multipliers would sometimes be larger and sometimes smaller than level-based multipliers, depending on the dynamics of the particular consolidation. That said, our multiplier estimates excluding speed and including all observations are very similar to Guajardo and others (2011). As the difference between multipliers depends on lagged effects, we tried extending the length of consolidation episodes by a year for all but the longest consolidations. This barely affects the point estimates of the interaction term *(γ),* but reduces the precision of the coefficients.

B. A Sample on Consolidation Episodes

Estimating equation *(E1)* necessitates a sample of consolidation *episodes.* This is distinct from the annual fiscal efforts collected in conventional fiscal datasets. To construct a dataset of consolidation episodes, we build on the so-called "narrative approach". This approach was first used by Romer and Romer (2010) (R&R) to collect tax discretionary measures in the U.S.; Devries and others (2011) then applied it to identify consolidation measures in a broader group of countries. Departing from the standard cyclically-adjusted primary balance (CAPB) metric—purely statistical in nature—the narrative methodology looks into the actual discretionary measures (documented in original sources) aiming for deficit reduction. The narrative approach minimizes measurement errors and reverse causality problems, which are of a lesser concern than with the CAPB measure.

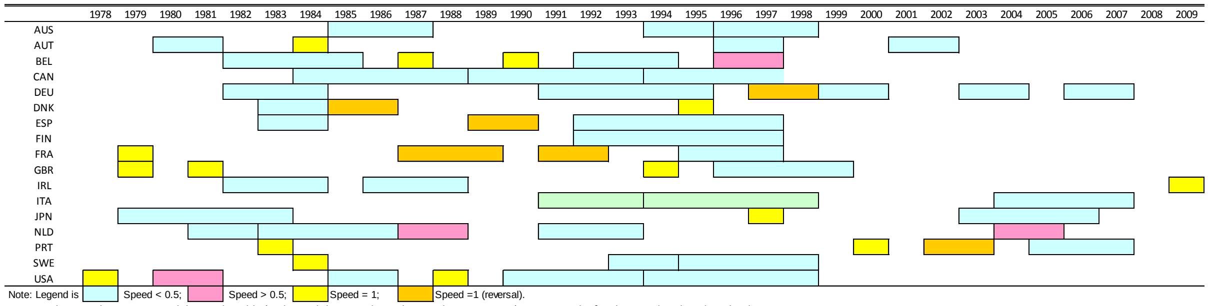
For the purposes of this study, the narrative method greatly assists with the delineation of consolidation episodes. Starting from the catalogue of measures in Devries and others (2011),[8] who construct a fiscal consolidation dataset for 17 OECD economies using the R&R methodology, we regard as consolidation *episodes* the following (Table 1):

- All tax hikes and spending cuts performed through the same multi-year budget measure. For instance, the *1993 US Omnibus Budget Reconciliation Act* (OBRA), enacting fiscal changes over U.S. fiscal years 1994-98, falls under this category.

- The combination of back-to-back annual consolidations into single multi-year adjustments. The presumption is that rational agents would, on average, anticipate, at any year *t*, the adjustments in the upcoming years. We limit consolidation episodes to around five years by using electoral dates as well as commentary from the literature (Giavazzi and Pagano, 1990; Mauro, 2011).

[8] This dataset misses some supplementary measures enacted outside the usual budget cycle (see Perotti, 2011b).

Table 1. Consolidation Episodes by Speed



For Australia, Canada, Japan, UK and the US, the table (and consolidation and GDP data used in regressions) represents the fiscal year rather than the calendar year.

C. A Novel Concept of Speed

Estimating equation *(E1)* further requires measuring the speed of all of the consolidation episodes reflected in Table 1. The notion of speed used in the empirical analysis is

$$\text{Speed}=2\left|\left(\frac{1}{N-1}\sum_{i=1}^{N-1}\frac{savings_{t+i}}{savings_{t+N}}\right)-0.5\right| \qquad (E5)$$

where N is the duration of the consolidation, $savings_{t+i} = surplus_{t+i} - surplus_{t+i}^{baseline}$ and *surplus* is the budget surplus as a share of GDP [9].

The construction of speed involves two steps: (i) measuring how front- or back-loaded are the consolidation episodes (i.e. its timing); and (ii) calculating the deviation from a "steady" path of consolidation, one that features an even distribution of the adjustment across time. The first term inside the absolute value calculates the timing aspect through a Gini-type coefficient on the inequality of *savings* to the budget. This is given by the average annual savings accruing to the budget during the first *N-1* years (as a percent of GDP) over the total consolidation savings. The rest of the expression measures the deviation from a "steady" path and normalizes speed to be between 0 and 1. The slowest consolidations are scored 0 and feature steady patterns of adjustment.

The more the consolidation measures are concentrated in specific years, the closer speed is to unity, with fully front- or back-loaded profiles scoring a speed of 1. Intuitively, a three-percent-of-GDP consolidation undertaken over 3 years would score speed 1 if all cuts were to be concentrated in either the first or the third year; 0 if cuts were carried out at the yearly pace of one percent of GDP;[10] and 0.5 if., e.g., 2 percent of cuts were in the first or last year with 0.5 percent cuts in the other two years.

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[9] For the sake of simplicity, equations *E3, E4,* and *E5* do not discount future flows of growth and savings. As the average consolidation is just a few years long, discounting should not make a material difference.

[10] This implies *savings* to the budget of 1, 2, and 3 percent of GDP in, respectively, years 1, 2, and 3.

The concept of speed put forward in equation *(E5)* is applied to all sample consolidations, irrespective of their length. However, before determining on the exact sequence of spending cuts or tax hikes, a policymaker must decide whether to consolidate very quickly (in one budget for example), or consolidate more slowly. To capture this first-order question, we define a speed dummy variable (equal one if speed=1, zero otherwise), and investigate its effect on the multiplier by replacing speed with the dummy in the estimated equation *(E1).* Results are in Table 2 in Section IV.

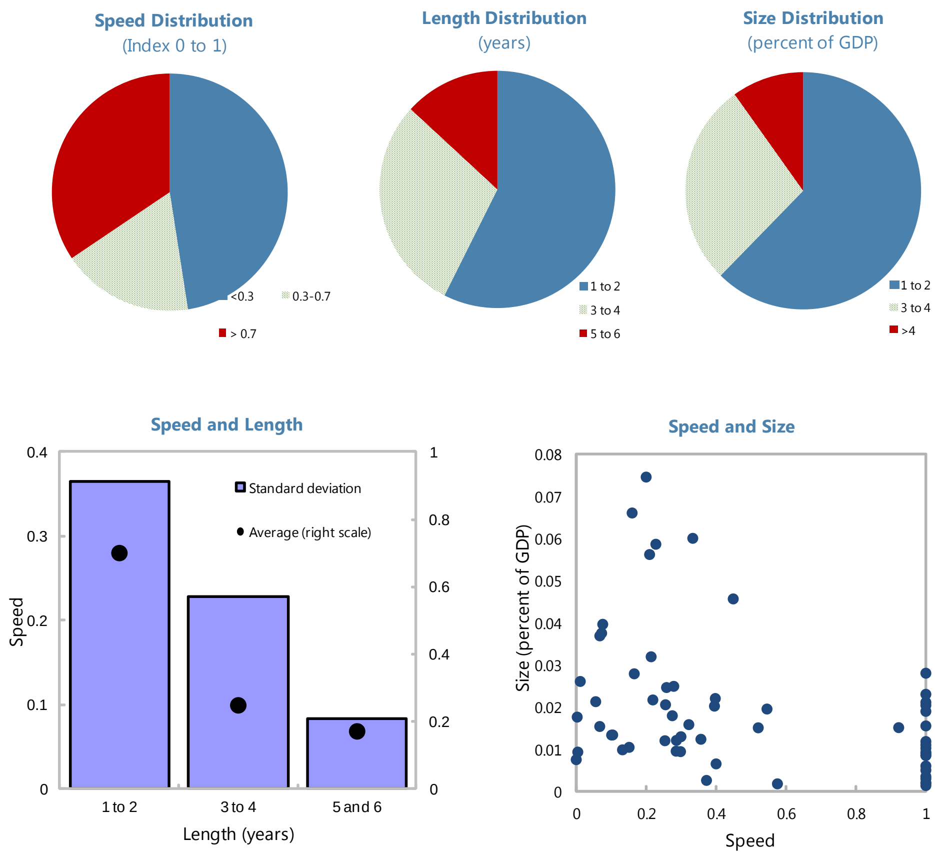
D. Putting it All Together: What Do Sample Consolidations Look Like?

The sample comprises 63 adjustment episodes. The median consolidation episode involves cuts of around 2 percent of GDP[11], is 2 years long and is more back-loaded than a steady pace of adjustment (Figure 2). The distribution is somewhat skewed towards low and high speeds, with around one-fifth of the observations having a speed 0.3 to 0.7. On pair-wise correlations, speed is weakly related to size (correlation of around -0.4), but more closely linked to length (correlation of -0.7): short consolidations in the data tend to be faster, and long episodes slower.

The analysis in Section IV retains speed and disregards length. Given that they are highly correlated and that it is difficult to predict which one is redundant, both speed and length could be used in multiple regression analysis if the sample were large. Constrained by a small sample size, we think there is good reason to bet on speed. This is because a regression with length constraints very different consolidation profiles to have the same effect on the multiplier. For example, length cannot distinguish between a steady path of adjustment over 5 years (e.g., cuts of 1 percent of GDP per year) and a front-loaded consolidation of equal final size (e.g., a 4-percent-of-GDP cut in the first year, followed by a 0.25-percent-of-GDP cut in each of the subsequent four years). But, these paths could have very different effects on the economy, and so they would codified differently by speed.

[11] The total average annual savings to the budget (equation *E4*) over the adjustment period are around 1.5 percent of GDP.

Figure 1. Sample Consolidation Episodes: Speed, Length and Size
(17 Advanced Economies, 1978-2009)



Note: Size = average annual savings from the consolidation as a share of GDP; Speed = see equation (E5); Length = years.

IV. Does the Speed of Consolidation Matter for Growth?

This section reports the main empirical findings in support of our core hypothesis that the speed of consolidation may, beyond size, have a bearing on fiscal multipliers. Before we proceed, it is important to check for consistency between the multipliers estimated on the basis of a sample of the multi-year episodes identified in this paper and those generated from annual data in other studies. Across the whole sample, we find that larger consolidation episodes are associated with growth further below trend (Figure 2; Table 2, R1), with an implied multiplier of around 0.9. The point estimate is within one standard error of the 0.6 multiplier estimated by Guajardo and others (2011) from the annual fiscal dataset of Devries and others (2011)—the same dataset we use in this paper to identify multi-year adjustment packages[12].

[12] Regression R1 in Table 2 has five influential observations. The estimate including influential observations has a coefficient of -0.7 (significant at the 5 percent level), which is similar to the multiplier estimate in Guajardo and others (2011) of 0.6.

Table 2: Baseline and Speed-Augmented Multiplier Regressions

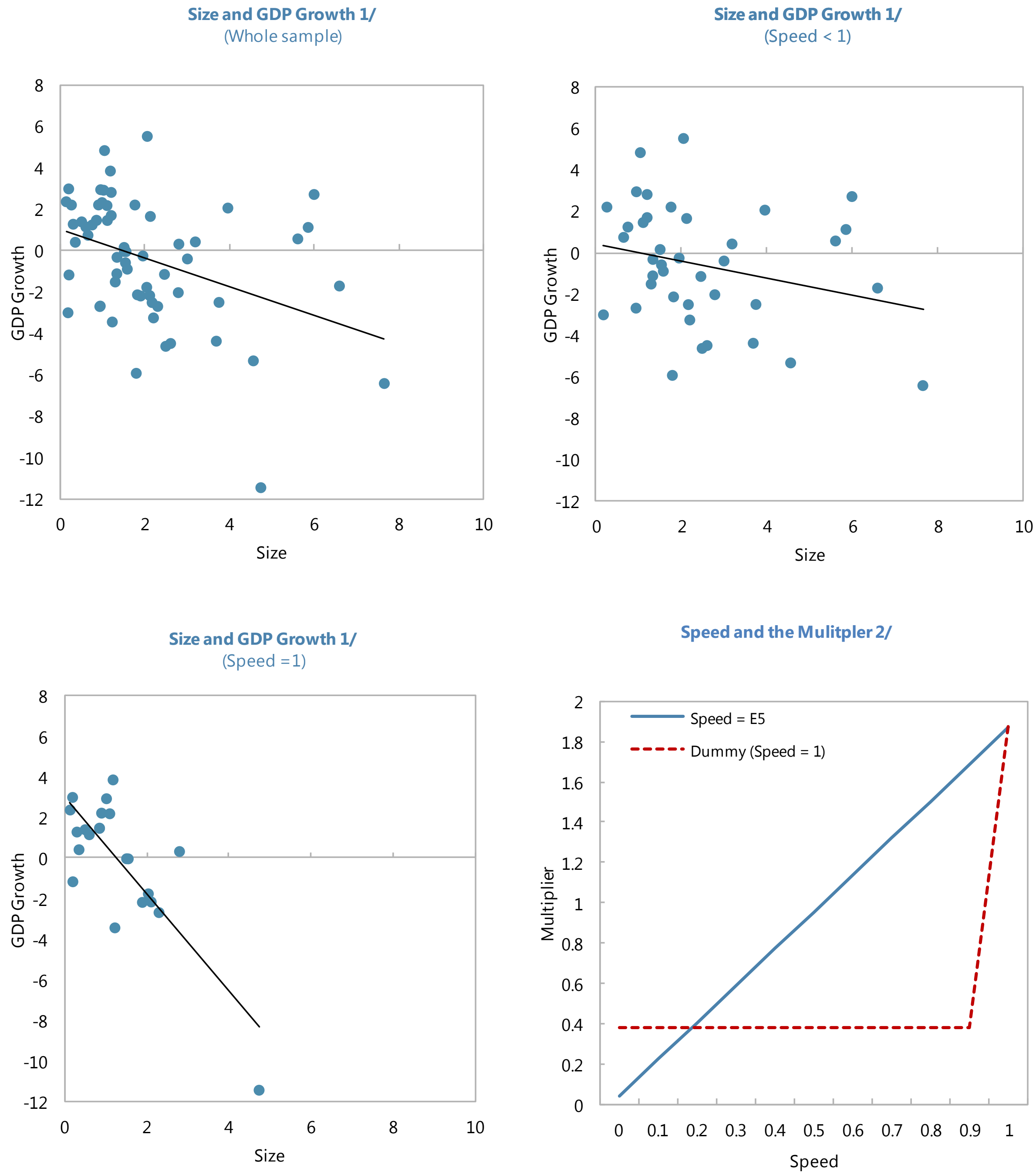
Dependent variable:	GDP Growth		
	R1	R2	R3
Speed measure:	None	E5	Dummy
Size *(β)*	-0.88***	-0.04	-0.38
	(-3.14)	(-0.12)	(-1.44)
Size X Speed *(γ)*		-1.79**	-1.50***
		(-2.64)	(-3.00)
Speed *(φ)*		0.02*	0.02**
		(1.92)	(2.24)
Observations	58	59	59
R-squared	0.17	0.15	0.15

Notes: Estimated equation: R1 = baseline multiplier regression; R2 and R3 = speed-augmented regression (E1). Speed concept: R2 = E5; R3= all speed 1 adjustments. Outliers excluded if Cook's distance>4/N. Table reports heteroskedasticity-robust errors in parentheses: ***, **, * denote significance at the 1, 5 and 10 percent levels, respectively.

We find evidence of higher multipliers for fast fiscal contractions. First, when interacted with size, unitary speed episodes have a significantly more negative association with growth than other consolidations (Table 2, R3, significant at the 1 percent level). Second, there is some evidence that steady adjustments have lower multipliers than accelerated episodes, be they front- or back-loaded (Table 2, R2, significant at the 5 percent level). Across R2 and R3, the estimated multipliers average 0.2 to 1.8 (Figure 2), with smaller multipliers for steady consolidations.

The results should be interpreted qualitatively (fast consolidations have higher multipliers) rather than quantitatively. Given the small sample size, the two parameters involved in the calculation of the multiplier in equation *(E2)*, β and γ, are estimated with low precision. Specifically, the 95 percent confidence interval around γ is quite wide (around ±1 to 1.3) and prevents us from rejecting at the 5 percent level the hypothesis that $-\gamma$ (the sensitivity of the multiplier to speed) is 0.5 larger for the fastest episodes—a long way below the point estimate $-\gamma$ =1.5 to 1.8. Likewise, estimates of β have a 95 percent confidence interval of around ±0.5 to 0.7, suggesting that multipliers for steady consolidations could be a good deal higher than the point estimate. Despite the wide confidence intervals, our estimates that $\gamma < 0$ is strongly significant, and hence fast consolidations have higher multipliers than steady consolidations.

Figure 2. Consolidation Size and GDP Growth: Whole Sample and Differentiated by Speed



Notes: 1/ Size = average annual savings from the consolidation as a share of GDP; GDP growth = average annual deviation from trend GDP growth over the consolidation period. 2/ Fitted values using the estimated coefficients in R2 (Speed= E5) and R3 (dummy for speed =1 consolidations).

V. ROBUSTNESS

This section discusses robustness along a number of dimensions, including a time-varying growth trend; alternative samples; additional control variables; outliers; and the choice of economies and the time period. We take each one in turn.

A. Time-varying Growth Trend

Our baseline specification uses a country-specific trend growth, which is invariant to changes in the global economy. To consider a time-varying growth trend we replace $\left(g_{c,t+i} - \overline{g}_c\right)$ in equation (*E3*) with $\left(g_{c,t+i} - \overline{g}_c - \overline{g}_{t+i}\right)$, where $\left(\overline{g}_c + \overline{g}_{t+i}\right)$ are estimated from a growth regression on time and country dummies. As a result, speed becomes significant at the 1 percent level in the two reference regressions (Table 3). With a varying GDP growth trend, the estimated multipliers turn out to be smaller, at around -0.1 to -0.5 in gradual consolidations to about 1.3 in the fastest adjustments. While multiplier estimates here are quantitatively different from those estimated elsewhere in the paper (and the literature), the qualitative evidence confirms that faster consolidations have higher multipliers.

Table 3. Robustness: Time-varying growth trend

Dependent Variable:	GDP Growth	
	R2	R3
Speed measure:	E5	Dummy
Size *β)*	0.48***	0.09
	(2.79)	(0.63)
Size X Speed *(γ)*	-1.75***	-1.39***
	(-6.43)	(-6.44)
Speed *(φ)*	0.02***	0.01**
	(2.72)	(2.54)
Observations	60	61
R-squared	0.24	0.19

Notes: Estimated equation: R2 and R3 = speed-augmented regression (E1). Speed concept: R1 = (E5); R3= all speed 1 adjustments. Outliers excluded if Cook's distance>4/N. Table reports heteroskedasticity-robust errors in parentheses: ***, **, * denote significance at the 1, 5 and 10 percent levels.

B. Alternative Samples

In this section, we show that our results are robust to two alternative methods for generating multi-year consolidation episodes: a "strict narrative approach" and the CAPB method of Alesina and Ardagna (2010). Tables 4-5 show that for all regressions across both samples, the speed measure is strongly significant (at either the one, or five, percent levels).

The strict narrative approach generates multi-year consolidations only if there are explicit multi-year budget measures in the narrative (such as OBRA 1993).[13] One key difference with

[13] Overlapping appropriations are also merged into longer consolidation episodes, or else it would be difficult to attribute growth in the overlapping year to one consolidation or another. This results in a 14-year consolidation for Canada. Judged as implausibly long for a single consolidation episode, this observation is dropped from the strict narrative sample.

the sample used in the rest of the paper is that back-to-back consolidations are *not* combined into multi-year consolidation episodes. This means that the assumption on perfect foresight is relaxed; it also involves less judgment in generating the sample. As a result, the strict narrative approach has fewer multi-year consolidations, more one-year consolidations and a larger sample size.[14] The estimated multipliers are within the 95 percent confidence of those stemming from the baseline sample.

The CAPB sample departs from the narrative approach, and instead uses statistical methods to identify consolidation episodes using data on primary fiscal balances. To minimize spurious small adjustments due to noise in the CAPB measure, only improvements of at least 0.5 percent of GDP per year qualify as consolidations. As with the main sample, back-to-back annual consolidations are combined into multi-year consolidations, and episodes longer than four years are broken down by elections. The countries and years are the same as in the main text.[15]

Table 4. Robustness: Strict Narrative Sample

Dependent variable:	GDP Growth	
	R2	R3
Speed measure:	E5	Dummy
Size *(β)*	0.83**	0.14
	(2.29)	(0.66)
Size X Speed *(γ)*	-1.70***	-1.02***
	(-3.31)	(-2.94)
Speed *(φ)*	0.02**	0.01
	(2.05)	(1.60)
Observations	93	94
R-squared	0.11	0.11

Notes: Estimated equation: R2 and R3 = speed-augmented regression (E1). Speed concept: R2 = E5; R3= all speed 1 adjustments. Outliers excluded if Cook's distance>4/N. Table reports heteroskedasticity-robust errors in parentheses: ***, **, * denote significance at the 1, 5 and 10 percent levels.

Table 5. Robustness: CAPB Sample

Dependent variable:	GDP Growth	
	R2	R3
Speed measure:	E5	Dummy
Size *(β)*	0.40*	0.2
	(1.82)	(1.17)
Size X Speed *(γ)*	-0.73**	-0.64**
	(-2.15)	(-2.31)
Speed *(φ)*	0.01	0.01
	(1.02)	(1.46)
Observations	98	98
R-squared	0.04	0.02

Notes: Estimated equation: R2 and R3 = speed-augmented regression (E1) in R2 and R3. Speed concept: R2 = E5; R3= all speed = 1 adjustments. Outliers excluded if Cook's distance>4/N. Table reports heteroskedasticity-robust errors in parentheses: ***, **, * denote significance at the 1, 5 and 10 percent levels.

C. Additional Controls

Expression *(E1)* is a reduced-form equation. As such, it omits a number of covariates possibly driving the differences across the multipliers presented in Section IV. Conceptually, these covariates could either respond to speed (thus rationalizing our results), or drive speed (thus engendering omitted variable and/or endogeneity bias). Pinning down the direction of causality is, however, particularly problematic given the small sample, the absence of

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[14] In addition to the strict narrative and CAPB approaches, we further tested a sample comprising explicit multi-year episodes along with back-to-back consolidations broken up by elections, regardless of their length. The overall speed and speed dummy coefficients are -1 (*t-stat=-1.75*) and -1.5 (*t-stat=-3.8*), respectively.

[15] Further details on these both samples are available from the authors.

instruments for speed, and the cross-section nature of consolidation episodes.[16] At a minimum, this section attempts to address two related questions, namely, is speed correlated with covariates (Table 6)? And, if so, do covariates emerge as significant in multiplier regressions in the place of speed (Table 7). This can help ruling out only very blatant cases of omitted variable bias.[17]

The set of covariates inspected in this robustness exercise are broken into two groups: those that capture potential mechanisms discussed in Section 2, and omitted variables that could be moving both speed and the multiplier.

- Potential mechanisms include composition effects as well as anticipation effects through net exports and monetary policy. These are captured by the proportion of the consolidation that is spending-based; the change in net exports to GDP in the first year of the consolidation; and the change in the nominal deposit rate. [18]

- Omitted variables possibly driving speed include: (i) two indicators of market pressure, namely the *t-1* debt-to-GDP ratio and the Institutional Investor Rating index on sovereign default risk (bounded 0 to 100, 100 = lowest risk); (ii) an indicator on the strength of a country's fiscal rules (codified 0 to 5, 5 = highest effectiveness) (Schaechter and others, 2012); (iii) the lagged unemployment rate (relative to a country-specific five-year moving average); (iv) the exchange rate regime (1=pegged; 2=crawling peg; 3=managed float; and 4=free float) (see "exchange rate arrangements and exchange restrictions" IMF database); (v) a financial crisis dummy (Laeven and Valencia 2010) in the first year of the consolidation.[19]

Practically, the sample size is sufficiently small that speed and the covariate are often both insignificant, even when covariates are added one-by-one as in Table 7.

- In terms of mechanisms, faster consolidations are sometimes significantly associated with a higher share of tax hikes (Table 6). Slower consolidations are associated with faster growth in net exports, but the coefficient is insignificant, as is the policy interest rate. When these variables are added to the multiplier regression (Table 7),

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[16] Cross-section data does not allow for testing Granger causality.

[17] A larger sample would further help distinguish between the effects of two highly correlated measures.

[18] We do not attempt to test asymmetries. This would require a triple interaction term *(speed x size x state of the economy),* which is constrained by the small sample size.

[19] We also looked for estimates on wage rigidity but measures that we found were not available for all countries and years in our samples.

either speed is still significant (in the case of the proportion of spending), or all variables are insignificant, which is indicative of a small sample size.

- Results for omitted variable bias are clearer. None of the covariates are significantly correlated with speed at the 5 per cent level (Table 6), and none of the covariates are significant in place of speed for both speed specifications (dummy and *E5* in Table 7).[20] Although speed is often insignificant (equation *E5*), so are other covariates, which probably reflects empirical constraints imposed by a small sample size. This is consistent with the results based on the larger CAPB sample (not reported): when additional controls are added, the overall speed variable is almost always significant.[21]

As far as length is concerned, it is a related concept to speed thus distinct from the competing channels and omitted variables examined above. Significantly correlated with speed, the model has difficulty disentangling the effects of speed and length on the multiplier.

Table 6. Robustness: Determinants of Speed

Dependent Variable:	Speed, E5		Speed, Dummy	
	Coefficient	*N;R2*	*Coefficient*	*N;R2*
Fiscal Rules	0.08	27	-0.04	27
	(0.95)	0.02	(-0.38)	0.00
Debt-to-gdp Ratio	-0.22	52	-0.26	53
	(-1.27)	0.02	(-1.65)	0.03
IIR	0.00	61	0.00	61
	(0.86)	0.01	(0.35)	0.00
Proportion of Spending	-0.22	62	-0.51**	58
	(-1.30)	0.03	(-2.56)	0.11
Exchange Rate Regime	-0.05	60	-0.04	60
	(-1.23)	0.02	(-0.71)	0.01
Unemployment	-0.10	60	-0.04	61
	(-1.23)	0.02	(-0.47)	0.00
Consolidation Length	-0.21***	62	-0.25***	61
	(-10.13)	0.52	(-8.93)	0.44
Financial Crisis 1/	-0.09*	59		58
	(-1.76)	0.00		0
Policy Rate	-0.02	60	0.02	60
	(-0.83)	0.01	(0.63)	0.00
Net Exports	-3.96	58	-3.73	59
	(-1.21)	0.02	(-0.86)	0.01

Notes: Estimated equation: *Speed = coefficient * control variable + error term.* Robust t-statistics in parentheses. Outliers excluded if Cook's distance>4/N. Table reports heteroskedasticity-robust errors in parentheses: ***, **, * denote significance at the 1, 5 and 10 percent levels, respectively.

1/ Not enough variation in the data to allow for estimation.

Table 7. Robustness: Speed regression augmented with covariates

Speed Measure:	Speed, E5					Speed, Dummy				
	β	ϕ	γ	δ	*N;R2*	β	ϕ	γ	δ	*N;R2*
Fiscal Rules	0.27	0.03	-2.51	0.19	24	-0.65	0.03*	-2.18***	0.27	26
	(0.26)	(1.59)	(-1.33)	(0.32)	0.07	(-0.45)	-2.01	(-3.34)	(0.40)	0.13
Debt-to-gdp Ratio	-0.92	0.01	-0.94	0.94	53	-1.29	-0.02	-1.18**	1.20	52
	(-1.00)	(0.78)	(-1.16)	(1.08)	0.12	(-1.51)	(-1.60)	(-2.09)	(1.46)	0.15
IIR	-3.82	0.02*	-1.39*	0.04	56	-4.60	0.02*	-1.36**	0.05	57
	(-1.34)	(1.80)	(-1.83)	(1.28)	0.21	(-1.55)	(1.90)	(-2.54)	(1.39)	0.20
Proportion of Spending	-0.52	0.02*	-1.72**	0.76	57	-0.71	0.02**	-1.65***	0.63	57
	(-0.97)	(1.94)	(-2.58)	(0.97)	0.17	(-1.38)	(2.30)	(-2.97)	(0.78)	0.17
Exchange Rate Regime	0.64	0.02	-1.07	0.02	57	-0.52	0.02**	-1.70**	0.11	56
	(0.64)	(1.56)	(-1.50)	(0.04)	0.13	(-0.48)	(2.41)	(-2.55)	(0.20)	0.17
Unemployment	0.07	0.03***	-1.62***	0.03	60	-0.30	0.02**	-0.99**	0.04	60
	(0.28)	(2.83)	(-2.80)	(0.22)	0.56	(-1.35)	(2.43)	(-2.30)	(0.27)	0.53
Consolidation Length	0.04	0.03*	-1.56	-0.05	55	-0.75	0.02*	-1.18	0.09	54
	(0.03)	(1.78)	(-1.39)	(-0.13)	0.23	(-0.61)	(1.70)	(-1.30)	(0.25)	0.25
Financial Crisis	-0.16	0.02	-1.18	-3.56**	60	-0.38	0.02**	-1.37**	-5.14**	59
	(-0.46)	(1.51)	(-1.63)	(-2.03)	0.16	(-1.42)	(2.06)	(-2.51)	(-2.10)	0.17
Policy Rate	-0.47	0.01	-0.69	-0.28	57	-0.58*	0.02	-1.05	-0.28*	57
	(-1.09)	(0.87)	(-0.93)	(-1.32)	0.18	(-1.69)	(1.36)	(-1.55)	(-1.81)	0.19
Net Exports	-0.15	0.01	-0.64	1.53	59	-0.25	0.01	-0.64	-1.02	59
	(-0.48)	(1.10)	(-0.94)	(0.16)	0.25	(-1.13)	(1.43)	(-1.15)	(-0.10)	0.26

Notes: Estimated equation: *GDP Growth =* $\alpha + \beta Size + \varphi\ Speed + \lambda\ Control + \gamma\ [Size \times Speed] + \delta\ [Size \times Control] +$ *error term.* Robust t-statistics in parentheses. Outliers excluded if Cook's distance>4/N. Table reports heteroskedasticity-robust errors in parentheses: ***, **, * denote significance at the 1, 5 and 10 percent levels, respectively.

D. Outliers and Influential Observations

Despite the small sample size, our key results are robust to the inclusion of influential observations (Table 8). The baseline regression reported in Table 2 uses the Cook's distance

[20] While speed *(E5)* is insignificant in Table 7, and the financial crisis dummy is significant, this seems to happen mostly through larger standard errors, and does not carry over to the dummy specification.

[21] We have also tried to condition on large consolidations (>1.5 percent of GDP), which some authors argue are more likely to be decisive. While γ is large and significant when all these observations are included, the speed *(E5)* specification is sensitive to influential observations. This is inevitable given that the sample size is now very small (around 35 observations).

to calculate influence and drop observations with a statistic higher than 4/N—a standard cutoff in the literature. Sweden 1995-98, Finland 1992-97, Belgium 1987 and Ireland 2009 are found to be influential (R2 and R3, Table 2) according to this criterion. Is it reasonable to drop these observations from the analysis? For various reasons, these episodes may not capture the standard effects of fiscal consolidation on growth. Running concurrently with a floating of the exchange rate, the fiscal contractions of Sweden and Finland were associated with depreciation and a related boost to external demand (Perotti, 2011b);[22] the 1987 fiscal consolidation in Belgium went hand in hand with output growing roughly at trend (unusual for even moderate estimates of the multiplier); and the fall in Ireland's GDP by 7 percentage points in 2009 (or 11 percentage points below the 1978-2009 trend) was largely related to the financial crisis and the slowing of its housing market.

An alternative check on influential observations is to re-estimate the basic speed-augmented equation *(E1)* with all observations but using the minimum absolute distance estimator—a method more robust to outliers than OLS[23]. The two speed metrics used in this paper are now significant at the 1 percent level (Table 9).

Table 8. Robustness: Outliers, OLS

Dependent variable:	GDP Growth	
	R2	R3
Speed Measure:	E5	Dummy
Size (β)	0.02	-0.41
	(0.06)	(-1.49)
Size X Speed *(γ)*	-2.16**	-1.99***
	(-2.62)	(-3.17)
Speed *(φ)*	0.03**	0.03**
	(2.06)	(2.54)
Observations	63	63
R-squared	0.27	0.30

Notes: Estimated equation: R2 and R3 = speed-augmented regression (E1). Speed concept: R2 = (E5); R3= all speed 1 adjustments. Equations are estimated usnig OLS, including all observations. Table reports robust errors in parentheses: ***, **, * denote significance at the 1, 5 and 10 percent levels, respectively.

Table 9. Robustness: Outliers, MAD Regression

Dependent variable:	GDP Growth	
	R2	R3
Speed Measure:	E5	Dummy
Size (β)	0.05	-0.31
	(0.11)	(-1.15)
Size X Speed *(γ)*	-2.63***	-1.98***
	(-2.87)	(-2.81)
Speed *(φ)*	0.04**	0.02*
	(2.13)	(1.70)
Observations	63	63
Pseudo R-squared	0.1	0.1

Notes: Estimated equation: R2 and R3 = speed-augmented regression (E1) in R2 and R3. Speed concept: R2 = (E5); R3= all speed = 1 adjustments. Equations are estimated usnig a minimum distance (median) regression, including all observations. Table reports robust errors in parentheses: ***, **, * denote significance at the 1, 5 and 10 percent levels, respectively.

E. The Choice of Economies and the Sample Period

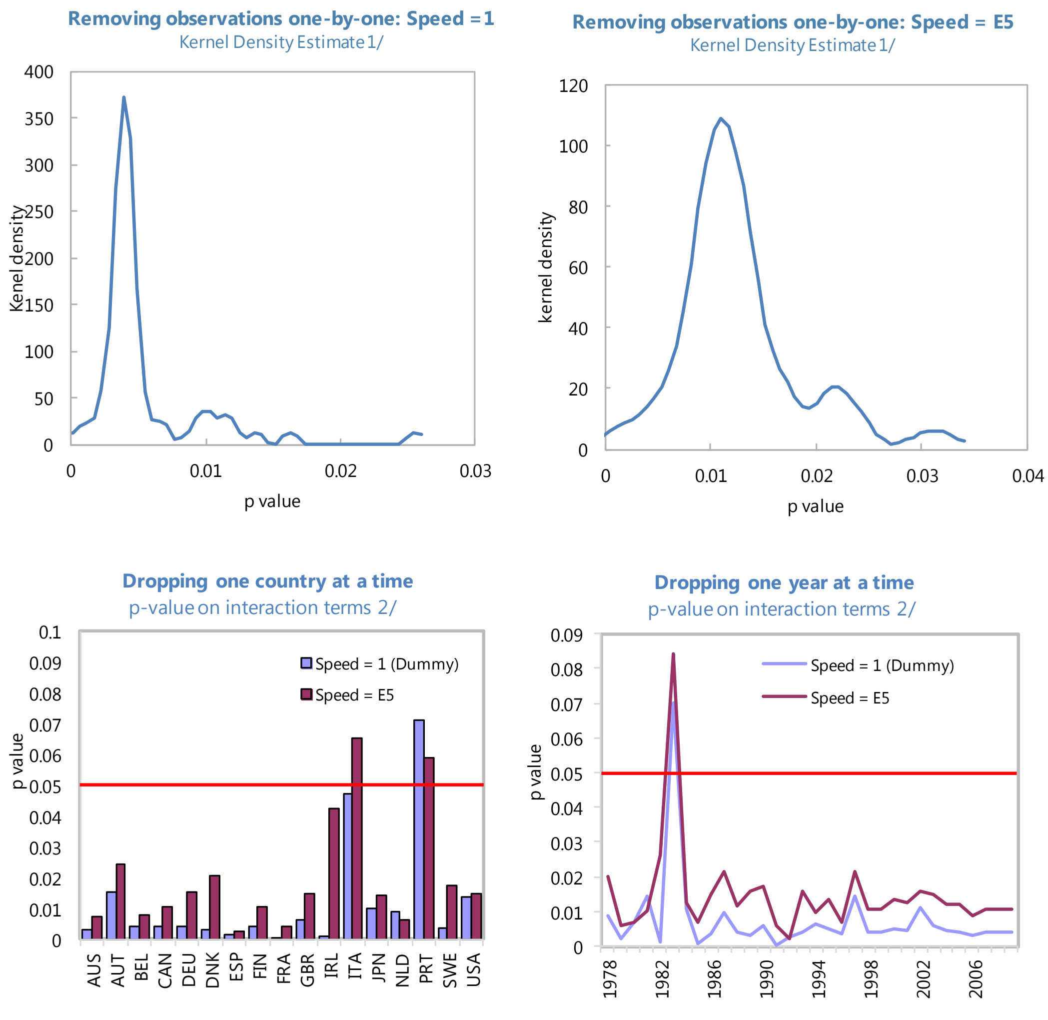
Starting from the estimates excluding influential observations (Table 2), results are robust removing observations one-by-one. To see this, we show kernel density estimates of p-values

[22] The output losses from banking crises in the early 1990s (Laeven and Valencia, 2010) are another reason to exclude these countries.

[23] The minimum distance estimator minimizes the absolute value of (instead of the square of) the residuals.

on the interaction term between size and speed when one observation is dropped at a time (Figure 3, top charts). The coefficient on the interaction terms between speed (dummy or by equation E5) and size are always significant at the 5 percent level (the corresponding density distribution only has probability mass with p-values less than 5 percent). Similar results are obtained dropping one country at a time or one year at time (Figure 3, bottom). Specifically, the interaction between size and either measure of speed (dummy or by equation E5) are nearly always significant at the 5 percent level.

Figure 3. Robustness to Choice of Economies and Sample Period



1/ Displays the distribution of p-value of the interaction term between speed and size when observations are removed one-by-one. Density distribution estimated using the Epanechnikov kernel method.
2/ Country/year indicated is the one that is dropped in each regression.

VI. CONCLUSIONS

In this paper, we show that the multiplier during episodes of fiscal consolidation is associated with the speed at which the adjustment takes place, with the fastest consolidations having the highest multipliers. We show this by augmenting a standard regression of growth on consolidation size with an additional term interacting size and speed. In the process, we make two contributions by (i) developing an index to measure speed, and (ii) creating a new sample of multi-year *episodes* to look at the *path* of fiscal consolidations (rather than relying on the annual fiscal efforts commonly used in the literature). We construct our episodes from the narrative provided by Devries and others (2011), which covers 17 advanced economies over 1978-2009.

These results fit into a growing literature which finds that there is no "one single multiplier", though we are one of the first to consider how it varies with speed. Our results can be motivated by composition, anticipation effects and asymmetries, though unfortunately we are not able to test these mechanisms due to a small sample size. Given the wide variety of consolidation paths in the data, and recognizing the importance of these factors in determining macroeconomic outcomes, it would be surprising if speed did *not* affect the multiplier.

Although it is difficult to identify a precise optimal pace, our findings suggest that a steady course of adjustment over several years may reduce the adverse affect of fiscal consolidation on growth. Even so, front-loaded profiles may be preferable to signal a resolute commitment towards fiscal consolidation when a country is facing an imminent debt crisis. Political economy considerations, such as reform fatigue or a reduced sense of urgency as the activity recovers may also make it difficult to sustain consolidation over time, calling for some front-loading of the adjustment.

Constrained by a small sample size, we see our results as a first step towards disentangling the relationship between speed and the multiplier, rather than the final word on the subject. While our result that very fast consolidations have higher multipliers is fairly robust, the regression that considers the full range of speeds is less so. The small sample also means that it is difficult to control for covariates, though we are unable to find solid evidence that they are important. Multi-year consolidation episodes are difficult to define, and while we consider several approaches to show robustness, it would be interesting to use other information such as private sector forecasts to pin down expectations about the future path of consolidation.

A. Appendix: Speed and the Multiplier in a New-Keynesian DSGE Model

This appendix discusses how, in a new Keynesian DSGE setup, the speed of consolidation affects the size of multipliers through anticipation effects. To illustrate this point, we discuss two polar profiles, fully front-loaded and perfectly steady. Both fiscal paths yield permanent savings to the budget. For a benchmark calibration we show that, as long as both packages are credible, the former comes with higher multipliers over the consolidation period. Further, the growth costs of moving fast are amplified by the presence of sticky wages and credit constrained households.

The model economy is closed and the representative agent maximizes the present value of expected log consumption, choosing between leisure and labor supply (Frisch elasticity of $1/(\eta\text{-}1)$); and between consuming today and consumption tomorrow. Output equals the labor supply $(Y=L)$. Wages are inversely related to the markup of monopolistically-competitive retailers, who change prices once a year on average—thus with probability $1\text{-}\theta=0.25$ (Calvo-sticky prices). The central bank sets the nominal interest rate i in response to inflation π_t (Taylor rule). Households pay lump-sum taxes[24] to finance unproductive government spending G, which follows an exogenous process with persistence ρ. The model features the following log-linear equations:[25]

$$\hat{Y}_t = E_t\hat{Y}_{t+1} - \left(i_t - E_t\hat{\pi}_{t+1}\right) - E_t\Delta\hat{G}_{t+1} \qquad \textit{(M1)}\text{[NK IS Curve]}$$

$$\hat{\pi}_t = \beta E_t\hat{\pi}_{t+1} + \kappa\left(\eta\hat{Y}_t - \hat{G}_t\right) \qquad \textit{(M2)}\text{ [NK Phillips Curve]}$$

$$i_t = \phi_\pi\hat{\pi}_t \qquad \textit{(M3)}\text{ [Taylor Rule]}$$

where $\kappa = \dfrac{(1-\theta)(1-\theta\beta)}{\theta}$ is the slope of the Phillips curve, G is government spending over GDP, and hats denote log deviations from steady state.

The benchmark calibration used for simulation purposes is as follows: $\eta = 1.5$, which implies a labor supply elasticity of 2 (an average of the values reported in Bernanke and

[24] With lump-sum taxes Ricardian equivalence holds.

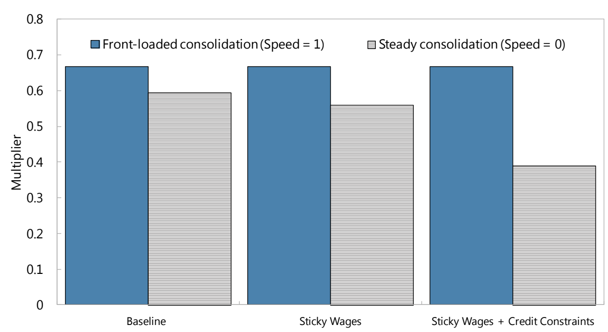
[25] When government purchases follow a *AR(1)* process like $\hat{G}_{t+1} = \rho\hat{G}_t + \hat{e}_t$ consolidations are temporary and the multiplier can be calculated by guessing and verifying that all variables follow an *AR(1)* process with persistence ρ. This yields $\frac{d\hat{Y}_t}{d\hat{G}_t} = \left[1+\frac{\kappa(\varphi_\pi-\rho)}{(1-\rho)(1-\rho\beta)}\right] \Big/ \left[1+\left(\eta\frac{\kappa(\varphi_\pi-\rho)}{(1-\rho)(1-\rho\beta)}\right)\right]$, which shows that the multiplier is decreasing with ρ. Thus less persistent (i.e. more front-loaded) adjustments have higher multipliers. Temporary consolidations are, however, less relevant to our study, whose primary focus is on permanent fiscal retrenchments.

others, 1999; and Christiano and others, 2004); β = 0.99, implying a riskless annual return of about 4 percent in the steady state; $\phi_\pi = 1.3$, which is the Taylor parameter estimated by Iacoviello (2005); κ = 0.09, which follows from $\beta = 0.99$ and, reflecting an average time interval of one year between subsequent price changes, $\theta = 0.75$.

We report multiplier outcomes for one-percent-of-GDP spending-based consolidations performed over a couple of years. The adjustment is permanent and perceived as credible by the public. To illustrate the interplay between anticipation effects and the pace of fiscal adjustment, we feature two extreme speed profiles, speed = 1 (or fully-frontloaded) and speed = 0 (or perfectly steady).

For speed =1, the multiplier collapses to the flexible-price multiplier of $1/\eta$=0.66. In this case, government purchases go down by 1 percent of GDP, and the households split their new-found wealth by consuming both more consumption and leisure. As leisure rises, labor and output drop in magnitudes dictated by the labor supply elasticity—0.66 in our benchmark calibration. For speed = 0, the fall in output is less than the flexible-price level, due to the offsetting effects from private consumption. On prospects for future reductions in government spending ($E_t\hat{G}_{t+1} < 0$), and the ensuing upward revision in permanent wealth, desired consumption increases today by the permanent income hypothesis. As the bulk of the spending cuts have not yet occurred, the increase in consumption boosts aggregate demand and hence output, as prices are sticky.

Figure A.1 - Speed and the Multiplier in a New Keynesian DSGE model
(Cumulative flow-based multiplier over two years)



Note: Baseline = Equations M1—M3 in body text; Sticky wages further assumes an average period of one year between price adjustments; Sticky wages + credit constraints further assumes that 25 percent of households have no access to capital markets. Multiplier is the flow of output relative to trend relative to the flow of consolidation savings relative to trend.

Gains from slowing down the pace of adjustment are enhanced in presence of sticky wages and a fraction of households that are credit constrained. In presence of sticky wages, the wealth-driven private demand push has less effect on inflation, and real interest rates will rise by less (having a positive effect on demand)[26]. With credit-constrained households[27], the wealth-driven private demand push will increase the wages of those facing liquidity constraints, increasing their income (which is spent), further expanding demand and reducing the size of the multiplier. Moreover, as credit-constrained agents do not

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[26] An increase in inflation leads to more than one-for-one rise in nominal interest rates ($\phi_\pi > 1$ by the Taylor principle).

[27] Labor demand is Cobb-Douglas in the two types of households (Giambattistia and Pennings 2013). Credit-constrained agents have a fixed share of labor and consume all their income each period. Ricardian households pay all lump-sum taxes, thus the whole model is Ricardian obviating the need for a fiscal rule.

react to interest rate changes, the upward pressure on real rates from the positive output gaps will have less of an effect on consumption.

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