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Spread Too Thin: Uncertainty Shocks and Diseconomies of Scope

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Abstract

Although many streams of literature have recognized that firms with broader scope often underperform those with greater focus, relatively little research has examined the mechanisms that might account for these diseconomies of scope. One potential mechanism is that uncertainty shocks — events or short-term periods that upset the normal course of business — place unusual demands on the limited attention of managers. When managers of larger, more diverse firms allocate their time and organizational resources to address these events, they necessarily divert attention and resources away from other businesses, thereby converting these uncertainty shocks in one part of the organization to performance shocks in other parts of it. An empirical examination of the relationship between the distribution of films in theaters and videos for sale demonstrates that uncertainty shocks in theatrical distribution become performance shocks in the video market and that the magnitude of these effects increases for larger, more diversified firms.

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1 Introduction

Organizations have been found to suffer from being too broad across a range of levels of granularity. Those operating across multiple countries have been found to generate lower returns on their assets than those operating in only one country (Christophe 1997, Denis, Denis, and Yost 2002). Organizations engaged in a variety of industries similarly appear to perform worse than those that compete in only one (Montgomery 1994, Berger and Ofek 1995). And even within industries, firms with more focused product lines appear to outperform those offering the greatest product variety (Fisher and Ittner 1999, Sorenson, McEvily, Ren, and Roy 2006).

Despite the ubiquity of this relationship between scope and performance, less research attention has been allocated to understanding the mechanisms that might account for it. One recent line of research does suggest that, in part, this relationship may stem from the perceptions of audiences, such as consumers, analysts and investors (e.g., Zuckerman 1999, Hsu, Hannan, and Koçak 2009). In these accounts, audiences rely on categories — such as nationalities, industries and product types — to help them to understand the world and to choose among competing offerings. When organizations do not fit neatly within a single category, they can cause confusion. Consumers, for example, might eschew the offerings of a producer with broad scope assuming that they are less well-matched to their needs (Hsu, Hannan, and Koçak 2009).

But the negative relationship between scope and performance might also emerge from the internal operations of organizations. To some extent, such a suggestion might seem surprising. After all, as organizations expand, they also build resources and capacity and they develop routines for coordinating activities across the firm. These resources and routines likely serve firms well on a day-to-day basis. What happens, however, when organizations face unexpected conditions? During such situations, organizations cannot simply rely on established routines, they must rather assess and respond to the changing conditions, an activity that usually requires a great deal of managerial attention often at the highest levels of the organization. As managers focus on responding to these conditions, they divert their attention, and possibly resources, away from other parts of the organization. Shoring up one competitive front, they leave others vulnerable.

While the attention mechanism is well known in theory (e.g., Van Zandt 1999), investigating the extent to which limited managerial attention might produce diseconomies of scope nevertheless poses an empirical challenge on a number of dimensions. First, it requires a setting in which firms experience unexpected events frequently enough to provide some statistical power. Second, and more rare, to separate the effects of these events on the internal operations of the firm from the consequences of the changing environmental conditions demands a setting in which some firms, but not others within the same industry, are exposed to these unexpected conditions.

To address these issues, we examine a somewhat unusual setting: the sales of movies both in the theatrical market and in video stores. Unexpected conditions, that we call "uncertainty shocks" occur on a semi-regular basis in the theatrical market, usually when some newly-released film turns out to have unusual and unexpectedly broad appeal. Because even the largest distributors only release a couple of dozen movies each year and because these shocks primarily affect other distributors releasing movies in the theatrical market at the time of the shock, each shock affects some distributors but not others. We then examine the effects of being exposed to these uncertainty shocks on the sales of films being released in the recorded video market. Our empirical design allows us to control for any common factors influencing all recorded video sales.

We find that exposure to an uncertainty shock in the theatrical market dramatically reduces the first month of sales of films being released at the same time in the recorded video market. Distributors with larger scope, measured in terms of larger aggregate screens or film budgets, experience larger declines in sales of recorded video, as do those carrying bigger-budget films or a larger variety of movies. These effects are all consistent with the idea that the allocation of limited managerial attention to uncertainty shocks leads firms to convert these uncertainty shocks into performance shocks in other parts of the business.

Our results have at least three important implications. Most directly, they suggest that distributors in the film industry may need to coordinate their theatrical and recorded video releases to perform as well as possible. In fact, looking at the results, one might ask why distributors do not simply time their recorded video releases on weeks in which they do not also have theatrical releases.

But this response has limits. As distributors release more and more films, they eventually reach the point where they are always involved in some new release. In this respect, our results speak to the literature on organizational scope and performance, suggesting that managerial attention may place a fundamental limit of the ability of firms to expand. Though the development of routines can allow organizations with broad scope to operate effectively on a day-to-day basis, they cannot guide the firm through poorly-understood periods. In contrast to previous work suggesting that larger scope is associated with lower uncertainty (e.g., Hund, Monk, and Tice 2010), the managerial attention mechanism would instead turn these limits on scope to become most binding, especially in rapidly changing industries and markets.

Finally, our results suggest another channel through which uncertainty shocks diffuse through the economy. Bloom (2009) proposes that uncertainty shocks can ripple through the economy as productivity shocks because firms temporarily postpone investments to assess the situation; the transmission of uncertainty shocks is thus envisioned as an industry-wide effect in which external forces affect investment decisions (e.g., Dunne and Mu 2010). Our results point to a similar effect but with a different mechanism. In diversified firms, uncertainty shocks in one part of the organization can also become productivity (or firm-level performance) shocks in other parts of it because they divert scarce managerial attention.

2 Data

We investigate the transmission of uncertainty shocks across two markets: feature film theatrical exhibition and home video sales in the United States. To study the theatrical market, we use weekly box office data on all films available from Variety / Nielsen. To study the video market, we employ proprietary data from Nielsen VideoScan, a leading provider of information on video sales. VideoScan covers a large sample of retail outlets except Wal-Mart, detailing weekly unit sales of each video title on 166,037 video items based on feature films, TV content and cable content between 1 January 2000 and 31 December 2009 in the U.S. The sample observations for our study are all those on video releases after 1 January 2000 that are matched to feature films released in the U.S. theatrical market after 1 January 1985.

We hand-match distribution companies and titles across both markets, identifying 2,808 feature films that were newly released in the video market between 1 January 2000 and 31 December 2009.[1] For our main tests, we focus only on the initial forty weeks of sales of these videos. In this sample of 112,320 video-week observations distributed by 220 distribution companies, video units sales are transformed into $log(1+units)$; this transformed series has a median of 5.96, a mean of 5.63, a standard deviation of 3.06; and only 7,476 data points are equal to zero.

Figure 1 describes the life cycle of films in the theatrical and video markets for the years 2000–2009. The samples are different because not all films released in the theatrical market are released in the video market.

[1]When comparing our sample with that of Ho, Ho, and Mortimer (2010), we find that our data sources include more years and more film released in video per year; however, the empirical settings are not wholly comparable because we study video sales whereas Ho et al. (2010) study video rentals.

3 Identifying and Testing for Uncertainty Shocks

Prior work has characterized the release of feature films in the theatrical market as a highly uncertain process (Hayes and Bing 2004, De Vany and Walls 2004, Moretti 2011). We build on this idea to assess the impact of *shifts in the overall level of volatility.* We thus depart from previous studies that have looked at uncertainty from a cross-sectional standpoint to look instead at shifts in this cross-sectional volatility that constitute second-moment shocks over time, that is, spikes in the time series of market volatility.

A unique feature of our empirical setting is that volatility can be accurately observed given the long (25-year) time series of box office revenues and their weekly frequency. Before laying out the empirical design, it is important to show that the theatrical market can be properly characterized as volatile (i.e., showing statistically significant second moment shocks). To do this, we exploit detailed data on all films and all weeks in the U.S. theatrical market.

Figure 2 plots the time series of cross-sectional standard deviations of weekly box office revenues in constant millions of 2009 dollars. In other words, within each calendar week of box office revenues of all films, we take the standard deviation of film revenues; with these summary statistics, we build the time series shown in Figure 2. Two patterns stand out. First, there are many spikes in the time series, suggesting that the theatrical market may pass stringent tests of volatility jumps (as detailed below); second, some of this variation appears to be seasonal, suggesting that the empirical design will need to control for seasonality in order to make inferences about the impact of uncertainty shocks.

One way to objectively determine whether the time series of theatrical market activity is volatile is to conduct statistical tests for jumps. To do this, we implement Barndorff-Nielsen and Shephard's (2006) two tests of time-series jumps: their jump-linear test and the adjusted jump-ratio test. We find that the data reject the null of no jumps at the 5.1% and 5.9% significance levels, respectively. In other words, the spikes in Figure 2 are sufficiently sudden and sharp as to reject the null that the series does not have volatility jumps. It is therefore clear that the theatrical market has highly significant second-moment shocks, thus providing a natural treatment variable for our empirical analysis. Specifically, in all subsequent tests, a week whose standard deviation of box office revenue is greater than twice the median of this time series is defined as an uncertainty shock week, as suggested by Bloom (2009). Only distributors releasing new feature films in the theatrical market in uncertainty shock weeks are considered as being treated; distributors that are not releasing films in those weeks provide the control group for the empirical tests.

3.1 Description of Uncertainty Shocks

Table 1 provides descriptive statistics and tests of mean differences for uncertainty shock weeks (n=155) and regular weeks (n=1,149) in the theatrical market. Shock weeks can be largely characterized as those with more blockbuster films opening and better results for winners than regular weeks. However, the ex ante uncertainty of which films may become winners and what may be the fate of those competing against them is sufficient to complicate the decision-making environment among those firms actively participating in the market during shock weeks.

To see more directly how different market characteristics may relate to the level of volatility in the theatrical market, Table 2 presents descriptive regressions using the variance of box office returns as the dependent variable. Recall that uncertainty shock weeks are defined as those with a very high (i.e., greater than twice the median) box office standard deviation, so the analysis of this continuous variable underlying the definition of shocks is informative. Several factors seem to be related to the volatility of the market in a given week. Importantly, it is not the number of films being shown or being just released that seems to carry most of the explanatory power. Instead, the size of opening films, measured in terms of their mean production budget and release screens, appears to be positively associated with the overall volatility of box office revenues.

3.2 No Mechanical Volatility Links across Markets

Because we are interested in studying the impact of uncertainty shocks *across markets*, it is important to determine whether the video market is as volatile as the theatrical market, to inquire whether reverse causality is possible, or whether the connection we propose is simply mechanical. To do this, we replicate the volatility jump tests in the video market. Figure 3 details two different samples on the video market employed for these tests: one including all weeks of the life cycle of videos, and one restricted to only their first 40 weeks. In both cases, the null hypothesis of "no jumps" cannot be rejected, suggesting that the video market is much less volatile than the theatrical market and should not pose an unobserved video-volatility mechanism in the empirical design.

Moreover, it is important to rule out a mechanical connection between the volatility of these different markets. Figure 4 jointly plots the time series of volatility of the theatrical market and the video market. There is no clear pattern of relation between these series, and their correlation is 0%. Therefore, no mechanical connection of volatilities across markets should be expected.

4 Empirical Design

We seek to understand the impact of uncertainty shocks on performance through a managerial channel. To do this, we extend the specification of Hendricks and Sorensen (2009) and introduce uncertainty shocks from the theatrical market into the analysis of the weekly sales dynamics of the video market.

Consider each new video release, i, in each of its life-cycle weeks t in the video market, where t goes from 1 to 40. Video i was released by distributor d in the theatrical market.

This distributor may also be distributing films in the video market. We are interested in measuring what happens when distributor d goes through an uncertainty shock in the theatrical market at a simultaneous time s when d is also distributing feature films in the video market. Specifically, treatment is defined as a dummy (I_d^s) answering the question: Is d going through an uncertainty shock at concurrent week s? The baseline specification is:

$$y_{it} = \alpha_0 + \sum_{t=1}^{40} \lambda_t * 1(week = t) + \sum_{t=1}^{40} \beta_t * I_d^s * 1(week = t) + \gamma * I_d^s + \alpha_i + \theta_w + \eta_y + \epsilon_{it} \quad (1)$$

This baseline specification is particularly robust for two reasons. First, it includes film fixed effects α_i, so that unobserved heterogeneity that is invariant at the level of each of the 2,808 distinct films in the sample is effectively accounted for. Second, specification (1) includes week-of-year dummies that account for seasonality, year dummies that account for the secular trend in video sales, and video-life-cycle dummies that flexibly vary the level of sales depending on how long each video has been on the market.

Given their granular nature, there are many ways in which weekly video sales may be correlated, altering the standard errors of the coefficients of interest. Specifically, sales of the same video item in different weeks cannot be assumed to be independent; and sales of different videos of the same distributor cannot be assumed to be independent over time or simultaneously. Hence, to be conservative, equation (1) is estimated clustering standard errors at the level of each distribution company.

While specification (1) allows for the estimation of the causal impact of uncertainty shocks over the life-cycle of video sales (i.e., coefficients β_t), it is silent about the mechanisms leading to such effect. We therefore extend this baseline specification to allow for a differential effect for those distributor-week observations that are above a median benchmark:

$$y_{it} = \alpha_0 + \sum_{t=1}^{40} \lambda_t * 1(week = t) + \sum_{t=1}^{40} \beta_t^{base} * I_d^{s,base} * 1(week = t) + \sum_{t=1}^{40} \beta_t^{large} * I_d^{s,large} * 1(week = t) + \ldots$$

$$\cdots + \gamma * I_d^{s,base} + \delta * I_d^{s,large} + \alpha_i + \theta_w + \eta_y + \epsilon_{it} \quad (2)$$

The median benchmark for 'large' is defined in several alternative ways but always using only weeks of uncertainty shocks; therefore, the mechanism coefficients are not a triple interaction but a differential coefficient for those distributor-week observations that are 'large' or above the median cases of uncertainty shocks.

5 Results

The diagnostic results reported in Section 3 reveal that the theatrical market undergoes a large number of uncertainty shocks, and that these shocks are not mechanically related to the volatility of the video market. We now investigate the impact of these volatility shocks affecting one part of the firm on performance, focusing on the potential mechanisms leading to different outcomes.

5.1 Uncertainty shocks and performance

Figure 5 reports the full set of coefficients β_t of specification (1), that is, the effect of uncertainty shocks from the theatrical market on video sales performance over each of the first 40 weeks of a video's life cycle. The picture is quite clear: distributors undergoing an uncertainty shock in the feature film theatrical market have significantly lower sales of videos they are just releasing. By contrast, the sales of videos with more than four or five weeks on the market are not lower for distributors affected by the theatrical uncertainty shock, suggesting that new releases are most vulnerable.

These baseline results are alternatively presented in a regression format in the first column of Table 3. The inclusion of fixed effects for each film, each year, and each week of the year helps to control for the unobserved influence of these common factors on sales.

Moreover, the video life week fixed effects take into account that recently-released films may have different performance expectations than films with a longer history on the market. The insignificant direct effect of an uncertainty shock on weekly video sales, shown as insignificant, suggests that it is the life-cycle of a product on the market that determines its vulnerability to an uncertainty shock.

One story for the sub-par performance of newly released products is that industry-level factors in the video market may be driving the results. Because this channel has little to do with the uncertainty shocks of the theatrical market, it is important to probe the robustness of the baseline estimates. The second column of Table 3 introduces market-week controls accounting for the intensity of competition through more products being released and more variability in their initial week performance. After the inclusion of these controls, the basic results remain unchanged, suggesting that an internal firm channel is a more likely explanation for the drop in performance.

It is also important to assess the impact on performance at a more aggregate level, as the negative performance effect uncovered so far at a weekly frequency may wash through a subsequent recovery in posterior weeks. The third column of Table 3 details that uncertainty shocks negatively impact the cumulative sales of films during their first weeks of market participation, suggesting that the results are robust to this alternative measurement of performance.

5.2 Mechanisms for the negative performance effects

Having found a substantial short-term decline in performance for distribution companies undergoing an uncertainty shock, we now turn to investigate what kinds of firms may be more severely affected by this disruption.

Specifically, we implement specification (2) using several alternative definitions to establish a median firm in a given week, thus calculating the differential effect of firms larger than this benchmark over a given dimension. Three dimensions are of particular interest: the size of a firm's slate of films in the theatrical market, the size of a the firm's newly released films in the theatrical market, and the dispersion of film size within a firm's new release slate. Each of these sources of heterogeneity is captured using the production budget of films on a slate, as well as the number of screens where these films are exhibited. Finding that the effects of uncertainty shocks are more pronounced for firms defined as 'large' would lend credence to the argument that there exist diseconomies of size and scope in this setting.

Figure 6 details the full set of coefficients β_t^{large} of specification (2), that is, the differential effect of uncertainty shocks on distribution companies with a large slate size (top charts), large new-slate size (middle charts), and high level of dispersion of films within the new-release slate of the firm (bottom charts). The interpretation of these mechanisms is slightly different in each case but overall story is quite consistent: much of the performance disadvantage noted in the previous subsection may be attributable to firms with a larger, more diverse scope.

Table 4 details the influence of these mechanisms on performance following a regression format. In contrast to the marginal influence coefficients β_t^{large} that were also displayed in Figure 6, the baseline coefficients β_t that are common to both large and small firms undergoing an uncertainty shock appear largely insignificant (or even positive, as in the case of the third column of Table 4). These findings are consistent with strong diseconomies of scale and scope driving the negative impact of uncertainty shocks on performance.

Several features of the empirical design suggest that the results could be explained by limited managerial attention among large, diversified firms. First, the size and diversity of firms exposed to the uncertainty shocks are measured at the *weekly* level, thus requiring a relatively high frequency generative process that cannot be fully anticipated by decision makers. We conjecture that this high frequency factor is managerial attention. Second, the joint operation of firms in the theatrical market and the home video market is in itself a (vertical) scope decision that can be conceptualized as an equilibrium result; the consequences of uncertainty shocks on the performance of this joint operation must somehow disrupt a pre-existing organization on a temporal basis; we conjecture that this time-varying dimension is the attention managers pay to their different projects. Subsequent versions of this paper will report more work required to bolster the managerial attention mechanism.

6 Conclusion

In this paper, we examine the transmission of uncertainty shocks across markets through decisions carried out by managers inside the firm. Specifically, we study the relationship between product scope and performance in the presence of severe disruptions to the decision-making environment. Employing granular data on the population of feature films released in the theatrical market and the home video market between 2000 and 2009, we find a strongly negative impact of uncertainty shocks on sales performance that is more pronounced for larger, more diversified firms. The results point to a novel mechanism for diseconomies of scope. Shifts in the level of market volatility place unusual demands on the limited attention of managers, who necessarily divert attention and resources away from key businesses, thereby converting these uncertainty shocks in one part of the organization to performance shocks in other parts of it.

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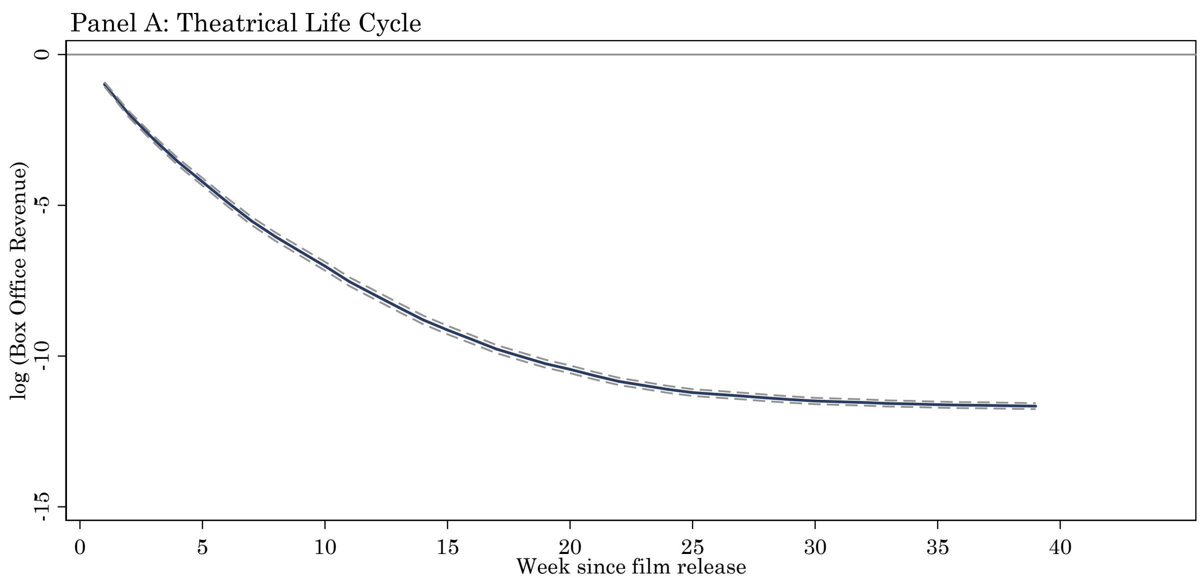
Figure 1: Weekly Dynamics of Theatrical and Video Sales

The graphs are based on the first 40 weeks of theatrical release or video release of each feature film i released between 1 January 2000 and 31 December 2009. All forty weeks are included for each film regardless of whether they have sales. The charts report coefficient estimates and standard errors on λ_t from film fixed effect regressions

$$Sales_{it} = \alpha_0 + \alpha_i + \sum_{t=1}^{40} \lambda_t * 1(week = t) + \epsilon_{it}$$

where the dependent variable is box office revenue in thousands of 2009 dollars logged (Panel A) or video unit sales logged (Panel B). Standard errors are robust and clustered by film; 95% confidence intervals are displayed in dashed lines.



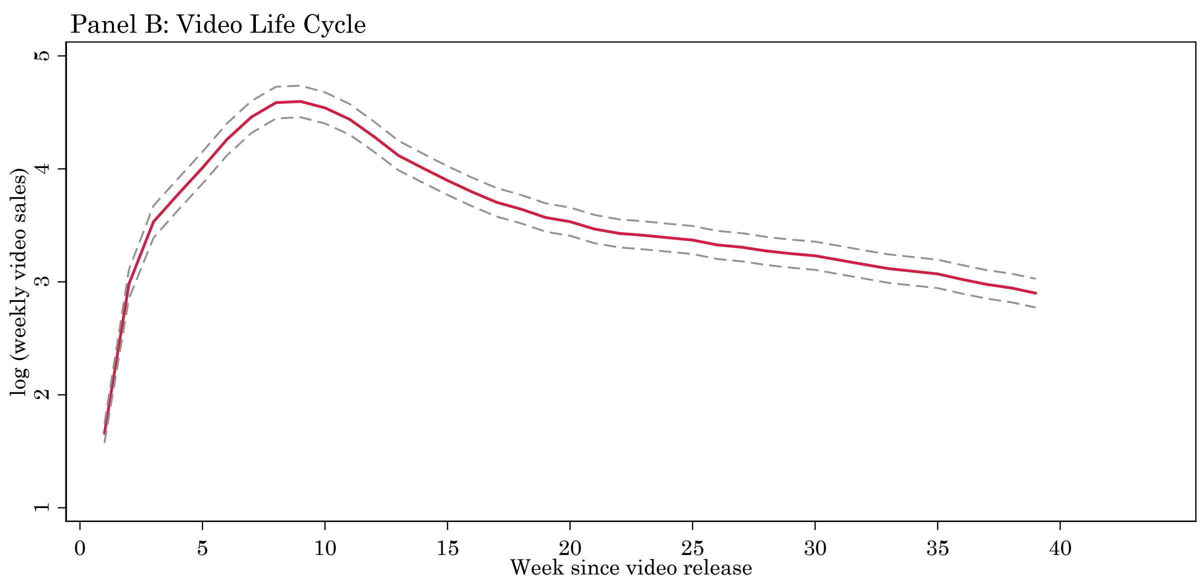


Figure 2: Theatrical Market Volatility

The data are at the weekly level for all weeks between 1985 and 2009. The plot displays the time series of cross-sectional standard deviations of weekly box office revenues in constant millions of 2009 dollars. This time series is the basis to implement both the jump-linear test and the adjusted jump-ratio test proposed by Barndorff-Nielsen and Shephard (2006). The data reject the null of no jumps at the 5.1% and 5.9% significance levels, respectively. Jump weeks will be considered uncertainty shock weeks. In all subsequent tests, a week whose standard deviation of box office revenue is greater than twice the median of this time series is defined as an uncertainty shock week.

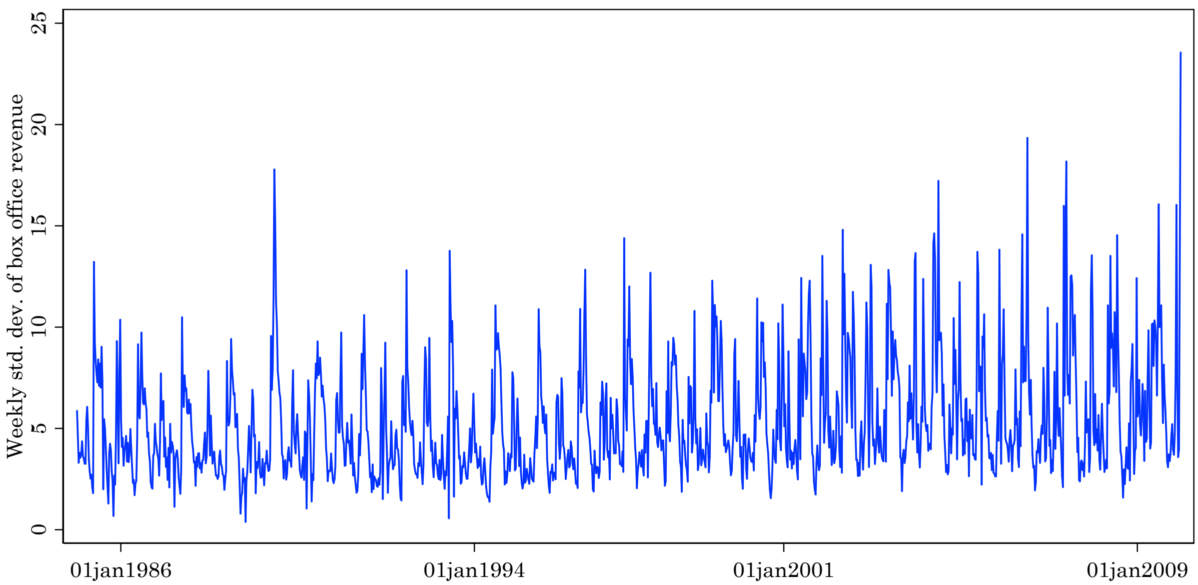


Figure 3: Video Market Volatility

This figure reports the data on the video market at the weekly level for the years 2000–2009.

Panel A uses observations on all feature film-based videos released after 1 January 2000 regardless of their life cycle. The plot displays the time series of cross-sectional standard deviations of weekly video sales in units. The p-value of the jump-linear test and the adjusted jump-ratio test proposed by Barndorff-Nielsen and Shephard (2006) is 47%, suggesting that the null of no volatility jumps cannot be rejected.

Panel B uses observations on feature film-based videos released after 1 January 2000 but only including their initial 40 weeks of life cycle. The p-values of the jump-linear test and the adjusted jump-ratio test proposed by Barndorff-Nielsen and Shephard (2006) are 77% and 78%, respectively, indicating that the null of no volatility jumps cannot be rejected.

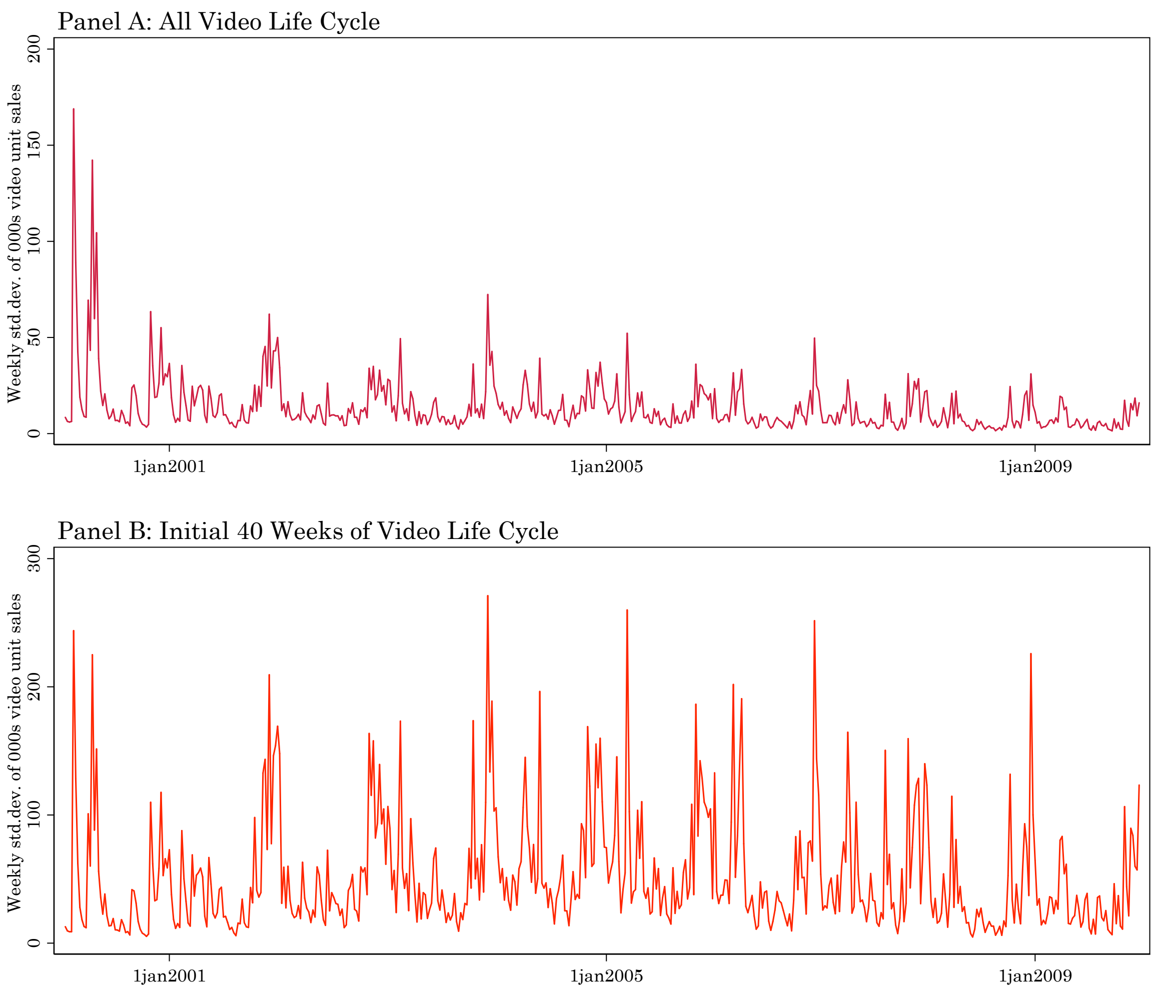


Figure 4: Aggregate Connection between Theatrical and Video Market Volatility

This figure reports the theatrical market volatility (equivalent to that of Figure 2) and the video market volatility for the initial 40-week cycle of videos (equivalent to that of Panel B of Figure 3) for the period 1 January 2000 to 31 December 2009.

The correlation between the two time series is 0.0018.

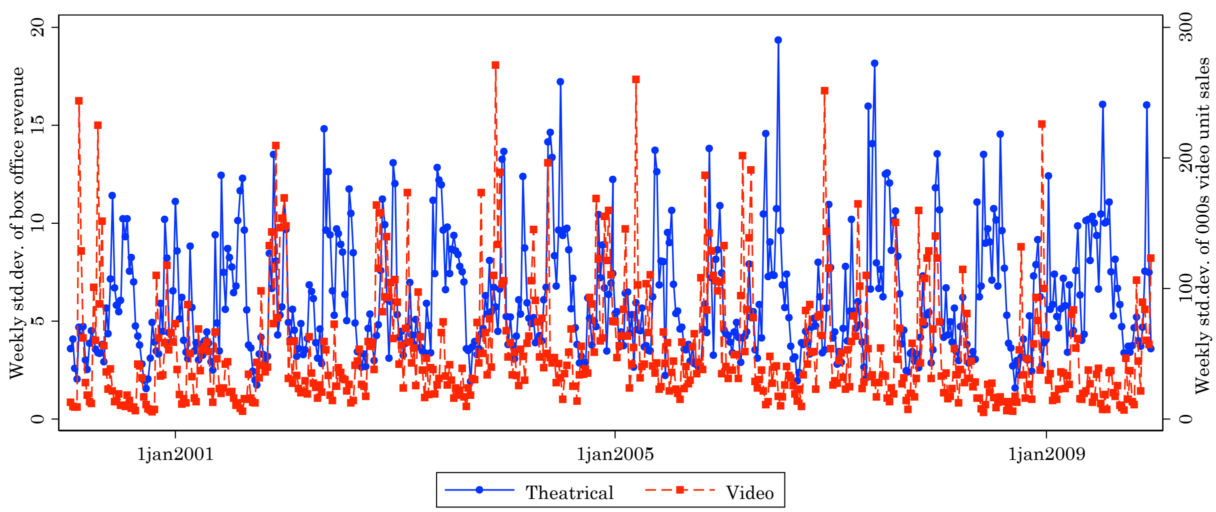


Figure 5: The Transmission of Uncertainty Shocks over the Video Life Cycle

The plot displays the estimated coefficients on β_t from equation (1) using the first column of Table 3 as the specification. 95% confidence intervals are shown in dashed lines.

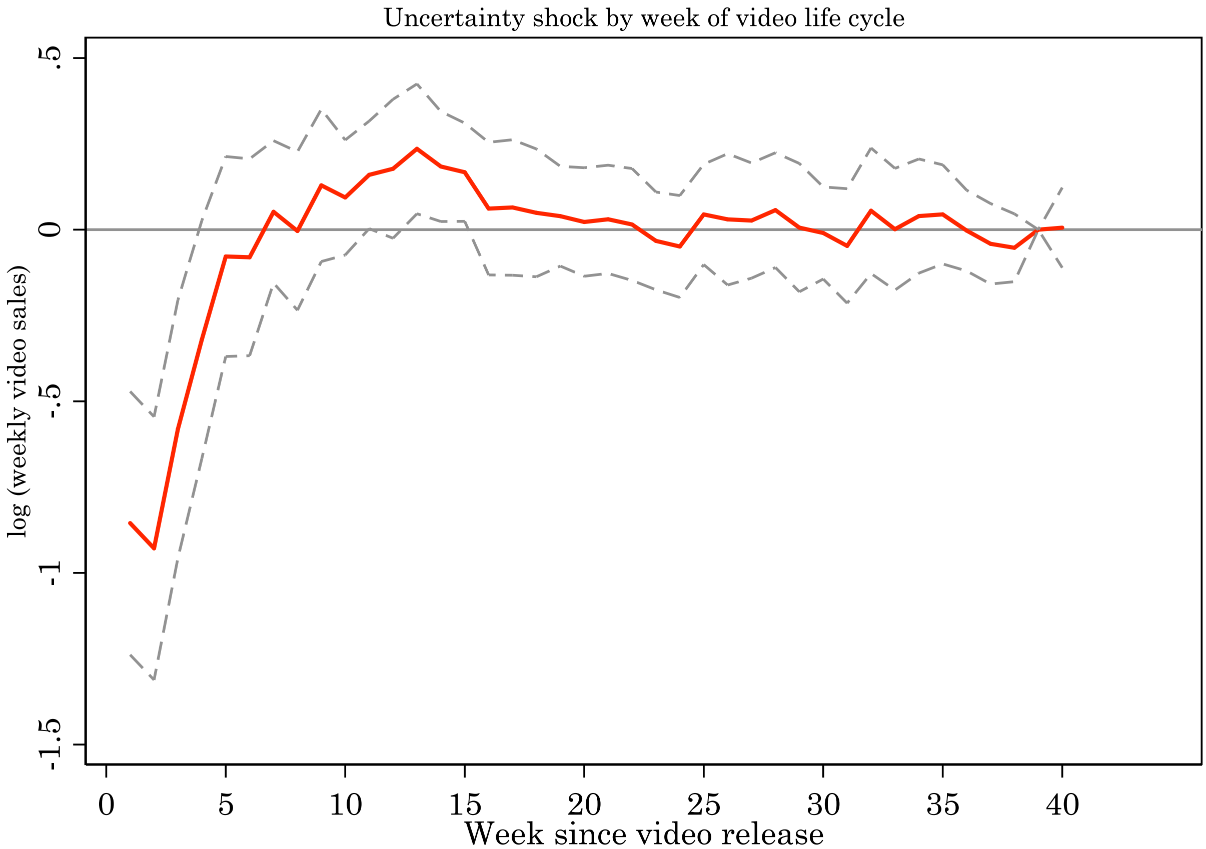


Figure 6: Mechanisms for the Transmission of Uncertainty Shocks

The plot displays the estimated coefficients on β_t^{large} from equation (2), as well as their 95% confidence intervals (in dashed lines). Each panel uses a different definition for *Large* but always refers to a median value calculated for the theatrical market each week. The first panel uses the median sum of screens of distributors on the market; the second column uses the median sum of production budgets of distributors; the third column uses the mean value of opening films screens, defining opening screens as those of first- or second-week films at that moment; the four column uses is also for first- or second-week films, taking their mean production budget to calculate the market median; the fifth column uses the standard deviation of opening screens of first- or second-week films; the sixth column uses the standard deviation of the production budgets of first- or second-week films.

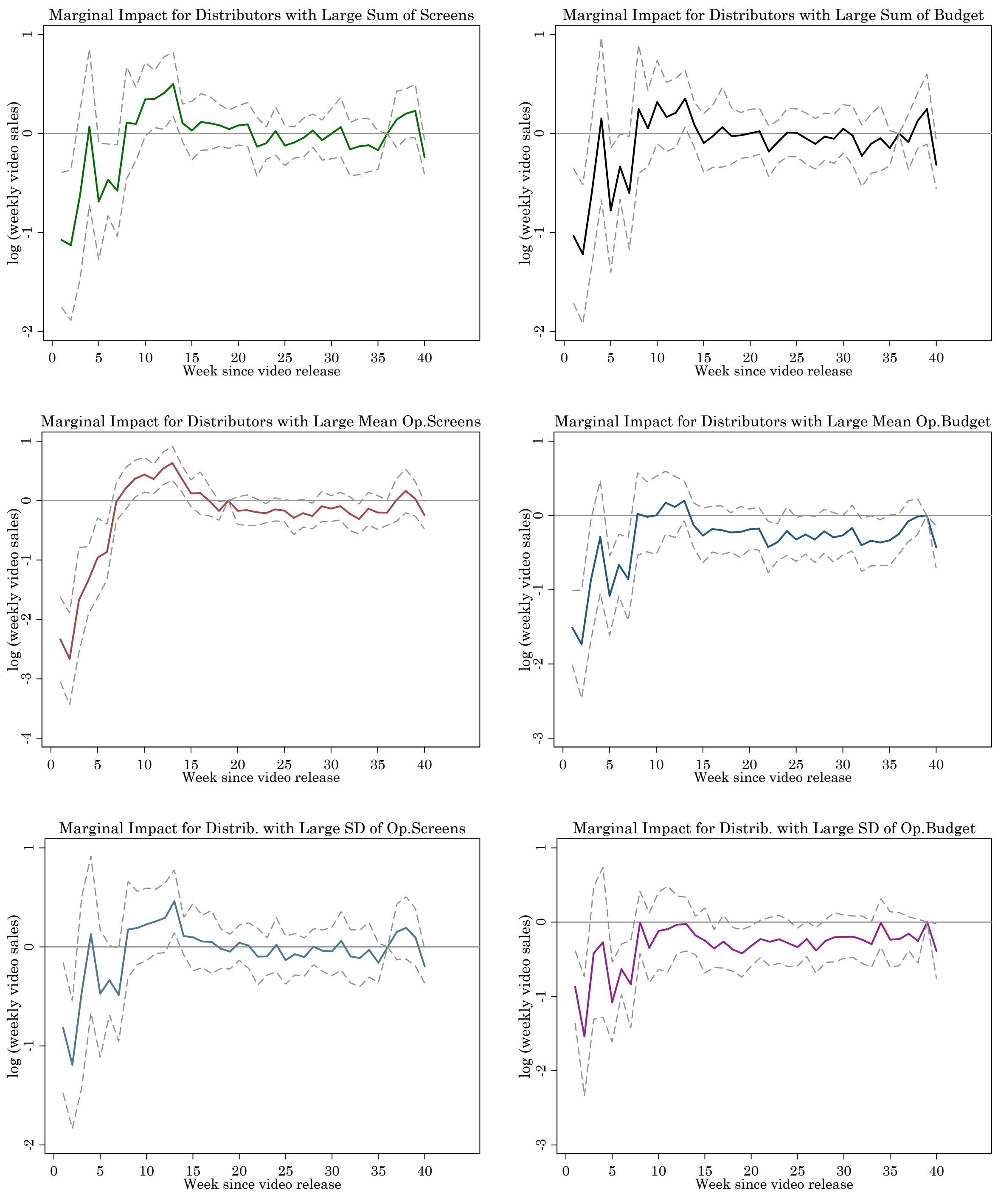


Table 1: Descriptive Statistics of the Theatrical Market

The unit of observation is a week, and the sub-samples are either no-uncertainty shock weeks (first column, n=1,149) or uncertainty shock weeks (n=155). The data come from the population of theatrical films released in the U.S. between 1 January 1985 and 31 December 2009. An uncertainty shock is defined based on the time series of weekly cross-sectional standard deviation of box office revenues of all films in each week, expressed in dollars of 2009; a week whose standard deviation of box office revenue is greater than twice the median of this time series is defined as an uncertainty shock week. Most variable definitions are self evident from the labels below. Herfindahl of opening films box office is a measure of how concentrated the market is in terms of each film's box office revenue. Film quality is obtained from IMDB user ratings, restricted to films with more than 471 votes (i.e., the 25% percentile of number of votes per movie).

Sample weeks:	**Shock=0**	**Shock=1**		For Shock=1 Weeks Only			
Variable	Mean	Mean	t-stat of diff	Min	Median	Max	SD
N. films on the market	91.821	102.768	-4.10	28.000	109.000	152.000	27.589
Sum B.O. all films	145.073	264.626	-28.86	119.184	259.491	494.781	57.450
Week above 99pc of historical weekly B.O.	0.000	0.090	-10.67	0.000	0.000	1.000	
Week above 90pc of historical weekly B.O.	0.032	0.600	-28.02	0.000	1.000	1.000	
N. opening films	7.359	7.084	0.90	0.000	7.000	21.000	3.853
N. films with max age 3 weeks	19.936	21.168	-1.90	3.000	21.000	46.000	7.399
Sum B.O. opening films	38.874	84.415	-15.28	0.000	92.629	259.567	64.345
Herfindahl of opening films B.O.	0.523	0.668	-7.64	0.182	0.649	1.000	0.236
Mean Prod.Budget of opening films	18.591	29.776	-10.85	0.026	26.426	95.600	18.141
N. films above 99pc of Prod.Budget	0.037	0.252	-9.94	0.000	0.000	2.000	0.478
N. films above 90pc of Prod.Budget	0.528	1.148	-8.44	0.000	1.000	4.000	1.098
Mean Op.Screens of opening films	0.629	0.741	-3.60	0.001	0.727	2.847	0.490
N. films above 99pc of op.screens	26.379	25.369	0.92	0.000	24.955	74.865	13.765
N. films above 90pc of op.screens	17.833	17.150	0.92	0.000	16.870	50.610	9.305
Mean quality of opening films	6.158	6.464	-5.88	4.800	6.580	7.725	0.565
N. films above 99pc of quality	0.070	0.071	-0.02	0.000	0.000	2.000	0.282
N. films above 90pc of quality	0.624	0.845	-2.87	0.000	1.000	5.000	0.927
Mean n. of principals in opening films	46.270	49.011	-2.70	16.667	47.896	85.250	12.676
Holiday	0.249	0.523	-7.25	0.000	1.000	1.000	
N. of sequels released	0.680	0.716	-0.54	0.000	1.000	3.000	0.762

Table 2: Weekly Volatility and Market Characteristics

The table reports regression models of weekly volatility for the theatrical market. The unit of observation is a week. The dependent variable, *Variance of box office revenues*, is calculated cross-sectionally over the week's box office revenues of all films in that week. All explanatory variables are defined in Table 1. t-statistics based on heteroskedasticity robust standard errors are reported.

Dependent Variable:	**Variance of Box Office Revenue**			
Indep. Variables (Squared)				
N. films on the market	0.001***		0.001***	0.000
	(4.39)		(5.08)	(1.49)
N. opening films		−0.004		
		(−0.18)		
Herfindahl of opening films B.O.			36.864***	35.374***
			(7.03)	(6.76)
Mean Prod.Budget of opening films				0.013***
				(5.34)
Mean Op.Screens of opening films				9.939***
				(3.50)
Mean quality of opening films				1.120***
				(5.10)
Mean n. of principals in opening films				−0.002
				(−1.29)
Holiday				17.718***
				(5.86)
Number of sequels released				1.095**
				(2.56)
Constant	27.136***	36.395***	13.038***	−37.237***
	(12.53)	(18.64)	(4.71)	(−5.00)
R^2	0.01	0.00	0.07	0.25
Sample size	1304	1304	1290	1274

***, **,* significant at the 1%, 5% and 10% level. t-statistics using robust standard errors are reported.

Table 3: Uncertainty Shocks and the Life Cycle of Sales in the Video Market

This table reports estimates of equation (1). Observations are at the video-week level for the first forty weeks of a video's life cycle. Only videos that are first releases of feature films in the video market after 1 January 2000 are included. The dependent variable is either the weekly number of video units sold (in logs) or the cumulative sum of video units sold (in logs). Uncertainty shock is defined as in Table 1. This variable is interacted with weekly dummies for each week in the video life cycle; the weekly dummies are also included as separate regressors in the form of video life week fixed effects. Only interaction coefficients for the initial five weeks are reported for brevity; all other coefficients are also obtained but not reported in this table. A graphical display of all coefficients in levels and interactions is shown in Figure 5. t-statistics based on robust standard errors clustered by distribution company are reported in parentheses.

Dependent Variable:	**Video Units Sold (in Logs)**		**Cumulative Video Units Sold (in Logs)**
Uncertainty shock	0.057	0.042	0.088**
	(0.77)	(0.58)	(2.32)
Uncertainty shock × (Video life week = 1)	−0.855***	−0.823***	−0.862***
	(−4.37)	(−4.21)	(−3.92)
Uncertainty shock × (Video life week = 2)	−0.928***	−0.913***	−0.964***
	(−4.75)	(−4.71)	(−4.62)
Uncertainty shock × (Video life week = 3)	−0.581***	−0.576***	−0.769***
	(−3.03)	(−3.04)	(−3.87)
Uncertainty shock × (Video life week = 4)	−0.320*	−0.305*	−0.530***
	(−1.81)	(−1.74)	(−2.97)
Uncertainty shock × (Video life week = 5)	−0.078	−0.067	−0.355*
	(−0.53)	(−0.46)	(−1.91)
Holiday week dummy		−0.057***	−0.038**
		(−3.05)	(−2.51)
Number of videos released this week		0.238***	0.037***
		(9.00)	(4.11)
Std.dev. of unit sales of videos released this week		0.024***	0.016***
		(6.00)	(4.39)
Analogous U.shock × each video life week through 40	Y	Y	Y
Film fixed effects	Y	Y	Y
Video life week fixed effects	Y	Y	Y
Year fixed effects	Y	Y	Y
Week of year fixed effects	Y	Y	Y
R^2	0.73	0.73	0.82
Sample size	112320	112320	112320
Number of clusters (distributors)	220	220	220

***, **,* significant at the 1%, 5% and 10% level. Standard errors are robust and clustered by distribution company.

Table 4: Mechanisms for the Impact of Uncertainty Shocks

This table reports estimates of equation (2). Observations are at the video-week level for the first forty weeks of a video's life cycle. Only videos that are first releases of feature films in the video market after 1 January 2000 are included. The dependent variable is the weekly number of video units sold (in logs). Uncertainty shocks are defined as in Table 1. Uncertainty shocks are further refined as those happening to above-the-median ("large") distributor-week combinations, using independent variables labeled as *Large distributor-week within shock weeks* to create the *Large* indicator variable. The definition of *Large* varies for each column in the table, but always refers to an above-the-median dummy calculated for the theatrical market each week. The first column uses the median sum of screens of distributors on the market; the second column uses the median sum of production budgets of distributors; the third column uses the mean value of opening films screens, considering only first- or second-week films at that moment; the four column uses is also for first- or second-week films, taking their mean production budget to calculate the market median; the fifth column uses the standard deviation of opening screens of first- or second-week films; the sixth column uses the standard deviation of the production budgets of first- or second-week films. The uncertainty shock variable and its Large refinement are interacted with weekly dummies for each week in the video life cycle; the weekly dummies are also included as separate regressors in the form of video life week fixed effects. Only interaction coefficients for the initial five weeks are reported for brevity; all other coefficients are also obtained but not reported in this table. A graphical display of all coefficients in levels and interactions is shown in Figure 6. t-statistics based on robust standard errors clustered by film are reported in parentheses. t-statistics based on robust standard errors clustered by distribution company are reported in parentheses.

	Dependent Variable: **Video Units Sold (in Logs)**					
"Large"=Defined as above median of:	Sum of screens	Sum of budget	Mean opening screens	Mean opening budget	SD of opening screens	SD of opening budget
Uncertainty shock	−0.161	−0.177	−0.201	−0.163	−0.073	−0.143
	(−1.22)	(−1.35)	(−1.16)	(−1.29)	(−0.59)	(−1.10)
Large distributor-week within shock weeks	0.140**	0.154	0.329***	0.388***	0.124	0.343***
	(2.06)	(1.46)	(3.63)	(3.00)	(1.53)	(2.67)
Large × (Video life week = 1)	−1.075***	−1.034***	−2.335***	−1.511***	−0.817**	−0.871***
	(−3.10)	(−2.98)	(−6.45)	(−5.94)	(−2.43)	(−3.50)
Large × (Video life week = 2)	−1.129***	−1.219***	−2.664***	−1.735***	−1.191***	−1.538***
	(−2.91)	(−3.41)	(−6.76)	(−4.66)	(−3.63)	(−3.76)
Large × (Video life week = 3)	−0.619	−0.575	−1.674***	−0.868**	−0.462	−0.419
	(−1.42)	(−1.53)	(−3.70)	(−2.10)	(−0.94)	(−0.92)
Large × (Video life week = 4)	0.069	0.152	−1.345***	−0.290	0.128	−0.271
	(0.17)	(0.36)	(−4.63)	(−0.75)	(0.32)	(−0.53)
Large × (Video life week = 5)	−0.687**	−0.777**	−0.960***	−1.083***	−0.472	−1.077***
	(−2.29)	(−2.42)	(−2.82)	(−3.98)	(−1.44)	(−3.94)
Uncertainty shock × (Video life week = 1)	−0.064	−0.080	0.804**	−0.001	−0.298	−0.336
	(−0.24)	(−0.29)	(2.29)	(−0.00)	(−1.29)	(−1.37)
Uncertainty shock × (Video life week = 2)	−0.122	−0.048	0.978***	0.040	−0.171	−0.045
	(−0.41)	(−0.15)	(2.63)	(0.14)	(−0.61)	(−0.14)
Uncertainty shock × (Video life week = 3)	−0.077	−0.092	0.616*	−0.094	−0.248	−0.339
	(−0.23)	(−0.37)	(1.75)	(−0.30)	(−0.71)	(−0.91)
Uncertainty shock × (Video life week = 4)	−0.232	−0.264	0.666***	−0.160	−0.343	−0.165
	(−0.75)	(−0.94)	(2.62)	(−0.52)	(−1.18)	(−0.45)
Uncertainty shock × (Video life week = 5)	0.481**	0.537**	0.650***	0.544**	0.263	0.571**
	(2.15)	(2.41)	(2.62)	(2.43)	(1.19)	(2.38)
Analogous interactions through week 40	Y	Y	Y	Y	Y	Y
Film fixed effects	Y	Y	Y	Y	Y	Y
Video life week fixed effects	Y	Y	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y	Y	Y
Week of year fixed effects	Y	Y	Y	Y	Y	Y
R^2	0.73	0.73	0.73	0.73	0.73	0.73
Sample size	112320	112320	112320	112320	112320	112320
Number of clusters (distributors)	220	220	220	220	220	220

***, **,* significant at the 1%, 5% and 10% level. Standard errors are robust and clustered by distribution company.