ROCKWOOL Foundation Berlin
Institute for the Economy and the Future of Work (RFBerlin)

DISCUSSION PAPER SERIES 49/25

Banking on Snow: Bank Capital, Risk, and Employment

Simon Baumgartner, Jakob Conradi, Thomas Schober, Alex Stomper, Rudolf Winter-Ebmer

www.rfberlin.com AUGUST 2025

Banking on Snow: Bank Capital, Risk, and Employment

Authors

Simon Baumgartner, Jakob Conradi, Thomas Schober, Alex Stomper, Rudolf Winter-Ebmer

Reference

JEL Codes: J412, J23, J24, G21

Keywords: Labor productivity, risk sharing, weather risk, quasi-fixed employment

Recommended Citation: Simon Baumgartner, Jakob Conradi, Thomas Schober, Alex Stomper, Rudolf Winter-Ebmer (2025): Banking on Snow: Bank Capital, Risk, and Employment. RFBerlin Discussion Paper No. 49/25

Access

Disclaimer

Imprint

RFBerlin
ROCKWOOL Foundation Berlin –
Institute for the Economy
and the Future of Work

Gormannstrasse 22, 10119 Berlin
Tel: +49 (0) 151 143 444 67
E-mail: info@rfberlin.com
Web: www.rfberlin.com

Banking on Snow: Bank Capital, Risk, and Employment *

Simon Baumgartner[a], Jakob Conradi[a], Alex Stomper[a], Thomas Schober[b], and Rudolf Winter-Ebmer[c]

[a]Humboldt University Berlin, Germany
[b]Auckland University of Technology, New Zealand
[c]Johannes Kepler University Linz, Austria

July 2025

Abstract

This paper analyzes how quasi-fixed employment responds to labor productivity risk. We use highly granular data on small firms employing workers whose productivity depends on weather conditions. This allows us to analyze effects of exogenous fluctuations in labor productivity risk, induced by weather risk. We find that the risk reduces firms' quasi-fixed employment, with a stronger effect in locations where regional banks have relatively little equity capital. We also find that in these locations the banks' borrowers receive less liquidity from their banks if the locations are subject to adverse weather shocks. Bank capitalization influences small firms' capacity to take labor productivity risk by changing their access to liquidity "insurance". Well-capitalized banks support economic adaptation to weather-induced labor productivity risk.

*We thank Josh Angrist, Karim Bekhtiar, Tim Eisert, Bernd Fitzenberger, Rainer Haselmann, Kilian Huber, Marcin Kacperczyk, Botond Köszegi, Jan Stuhler, Daniel Schäfer, Franz Hartl, Wolfgang Kleemann, Conny Wunsch and participants of the SOLE-EALE-AASLE World Conference and the European Finance Association Meetings, SKILS23, RES Glasgow as well as seminar participants of the Leopoldina (Bonn) and in Budapest, Frankfurt, Lancaster, Linz, Norwich, Vienna, and Würzburg. Thanks to the Austrian Central Bank (ÖNB Jubiläumsfonds), the FWF and the Austrian Christian Doppler Society for support. All errors are our own.

1 Introduction

This paper is motivated by evidence that, in advanced economies, firms typically provide their workers with insurance against *transitory* productivity shocks, offering them an employment which is quasi-fixed with respect to the shocks.[1] Given the prevalence of this form of employment, its fluctuations have macroeconomic implications.[2] This paper seeks to deepen our understanding of these fluctuations by analyzing effects of labor productivity risk. We document that these effects are influenced by financial frictions related to bank capitalization.

The analysis in the present paper builds on two ideas. The first is that firms take on a risk of cash flow shortfalls when offering stable incomes to workers whose productivity may be affected by transitory shocks. The second concerns a critical function of banks: providing liquidity to non-financial firms when they face transitory cash flow shortfalls (Holmström and Tirole, 1998, Kashyap et al., 2002, Gatev and Strahan, 2006). We combine these ideas in the hypothesis that if banks' ability to serve as liquidity providers is hindered by financial "frictions" this can reduce small firms' risk-taking capacity, thereby affecting their employment (the first idea). Our analysis tests this hypothesis with respect to frictions associated with banks lacking equity capital.

The relevance of the hypothesis appears, for example, in an analysis of Arellano et al. (2019) showing that the effects of the Financial Crisis can be modeled as arising from labor productivity risk and inefficient risk-sharing in the economy. For empirical analyses of such models' micro-foundations, we need a way of observing a risk of labor productivity shocks. We address this problem by focusing on firms employing workers whose productivity depends on the weather: service personnel at tourism businesses in Austrian ski resorts. The productivity of these workers is influenced by snow conditions in the ski resorts, as insufficient snow cover reduces tourists' demand for their services. This setting allows us to directly observe an exogenous risk of *transitory* shocks to worker productivity: The risk of a lack of snow at the start of the ski season, which is (almost certain) a transitory shock.

We document that the ski tourism firms respond to the risk by reducing employment ex-ante (i.e., before the risk materializes). This effect is much stronger in regions where local

[1] For the evidence regarding the effects of productivity shocks on employment relationships, see the literature on "insurance within the firm" (Guiso et al., 2005), surveyed, for example, in Pagano (2020) and in Guiso and Pistaferri (2020). The concept of quasi-fixity goes back to Oi's (1962) notion that labor is a quasi-fixed factor of production (being only completely variable in the long-run). In this paper, we use the term "quasi-fixed employment" to describe an employment which is stable (fixed) with respect to transitory (short-run) productivity shocks, while responding (in the longer run) to changes in the risk of these shocks.

[2] Quasi-fixed labor is a key topic for business cycles and labor productivity (Gali and van Rens, 2020). For example, DSGE macro models with labor hoarding due to quasi-fixed hiring and training costs perform better in explaining the dynamics and persistence of aggregate output (Haan et al., 2000).

banks have relatively little equity capital. Moreover, it is a direct effect of labor productivity risk on employment: By using highly granular data and firm-year fixed effects, we rule out that we indirectly measure effects of bank capitalization on investments in ski tourism. Our paper's main result thus complements evidence for "finance uncertainty multipliers" regarding investment (Alfaro et al., 2024).

Furthermore, we provide evidence supporting the second idea mentioned above, which concerns banks' liquidity provision to borrowers in areas affected by adverse transitory snow shocks. Does the extent of this liquidity provision depend on bank capitalization? We find that it does: In regions with higher bank equity capital, snow shocks lead to larger fluctuations in the interest income growth of regional banks. This suggests that, in these areas, tourism businesses can take on more labor productivity risk because their banks are more willing to tolerate reduced interest payments when the firms face cash flow shortfalls due to risk-taking. We also see a corresponding effect in (somewhat aggregated) firm-level balance sheet data we obtained from the Austrian Tourism Bank.

We now describe our analysis in more detail. Can we interpret the tourism businesses' hiring for the ski season as risk-taking? How are the firms responding to snow shocks? The first part of our analysis shows that, during the early weeks of the ski season, the firms' employment is indeed quasi-fixed in the sense that it does not respond to snow shocks (ex-post), even though it does adjust (ex-ante) to changes in the risk of such shocks. Like the firms in the model of Arellano et al. (2019), the ski tourism businesses appear to be solving a risk-taking problem. The more workers a firm hires with starting dates before a given week, the higher the risk of "idle" labor due to demand shocks from insufficient snow in this week. Towards the end of the season, snow risk ceases to be relevant because the firms respond to (now permanent) snow shocks with layoffs.

Do our results provide *generalizable* evidence that bank capitalization affects the sensitivity of the scale of firms' quasi-fixed employment to labor productivity risk? The alternative is that we observe an effect specific to our setting, - that bank capitalization correlates with variation in the sensitivity of labor productivity risk to snow risk. For example, bank capitalization may proxy for firms' ability to invest in facilities (e.g., hotel spas) that attract tourists when there is insufficient snow for skiing. To avoid that our regressions capture such effects, we construct IV estimates by exploiting an institutional feature of the Austrian banking sector: the prevalence of regional banks that are part of different banking groups with segmented internal capital markets. We use variation in the groups' aggregate equity capital to instrument the regional banks' equity capital. Our setting allows for assessing the validity of the instrument since we can observe a direct measure of labor productivity in ski tourism: tourists' overnight stays.

Our IV estimates reveal an effect of bank capitalization, which is not only statistically but also economically significant: Per basis point of bank equity, there is a 1.6% reduction in the semi-elasticity of employment with respect to exogenous labor productivity risk.[3]

We also document direct effects of bank capitalization on risk-sharing between banks, employers and employees. We find these effects in three types of data: aggregated firm-level balance sheet data from Austrian ski tourism businesses, balance sheet data from regional banks in ski resorts and wage data from Austria's social security database. We use these three types of data to specifically analyze effects of snow shocks during the weeks when employment in ski tourism appears to be quasi-fixed. The analyses yield consistent evidence for more risk-sharing between banks and employers in areas with more bank equity capital. For example, we find that, in these areas, snow shocks have bigger effects on bank interest income and employers' interest expenses.

The following section discusses our contribution to the related literature. Section 2 presents institutional details of the industry we focus on. Section 3 describes our research strategy. Section 4 describes our data sources and descriptive statistics. Sections 5 and 6 present our results. Section 7 concludes with a summary of our main results and a discussion of their external validity, also citing some additional related literature on family businesses.

1.1 Related literature

Our analysis tests the foundations of macro-finance models in which employment depends on financial frictions and the volatility of labor productivity. Two such models appear in Quadrini (2017) and Arellano et al. (2019).[4] The models highlight that firm-level employment decreases in the risk of labor productivity shocks if financial frictions affect the risk-taking of firms that occurs when the firms "insure" their workers against the shocks.[5] With this focus, the models represent a joint hypothesis concerning two effects of labor productivity risk on firm-level employment, i.e., the effect of changes in the risk, as well as the effect of actual labor productivity shocks. In the two models, the latter effect is set to zero – firm-level employment is assumed to be quasi-fixed.

We analyze a setting in which we can analyze both parts of the joint hypothesis. This puts our analysis at the intersection of two empirical literatures. The first literature analyzes direct effects of labor productivity shocks on employment and wages, while the second

[3]See Table 6, discussed in Section 5.2.2.

[4]These papers are part of a broader literature in which many contributions focus on investment, including seminal contributions such as the papers of Gilchrist et al. (2014) and Christiano et al. (2014). For a recent paper in this literature, see Alfaro et al. (2024), discussed below.

[5]In general equilibrium, part of the negative effect of increased volatility of labor productivity on employment is offset by a reduction in the wage level.

analyzes effects of risk. The papers in the first literature show that, in highly developed economies, firms typically offer their workers an employment that is insured against transitory firm-specific shocks, but workers receive less insurance against permanent shocks.[6] This suggests that effects of labor productivity risk on employment can only be interpreted conditional on the results of a prior analysis of the direct effects of the shocks caused by the risk. By using this research strategy, we obtain evidence that quasi-fixed employment responds to changes in labor productivity risk, making sure that we actually analyze a risk of shocks that do not cause layoffs.[7] This result adds to the second literature mentioned above. In particular, it complements findings of Alfaro et al. (2024) who analyze effects of uncertainty shocks on firm-level investment, employment, sales and a range of financial outcomes. For investment, they also find that the effect of uncertainty is modulated by financial frictions. We make a similar point, but regarding firm-level employment. Our evidence comes from variation in employment within firm-years which is not driven by investment.

Our analysis is motivated by evidence regarding financial consequences of quasi-fixed labor costs,[8] suggesting that the scale of firms' quasi-fixed employment should depend on their access to finance. We document this, contributing to the literature on real effects of bank capitalization:[9] We report the first evidence that banks' equity capital buffers modulate effects of exogenous labor productivity risk on employment. This complements evidence that bank capitalization affects the speed of economic recoveries after recessions. (Jordà et al., 2021). The latter evidence points to effects of bank capitalization on the risk-taking capacity of firms in the real economy because risk/uncertainty tends to rise in recessions (Bloom, 2014, Bloom et al., 2018).

Our paper adds to the literature about effects of financial market imperfections on employment. This literature consistently finds that contractions in credit supply reduce employment (e.g. Chodorow-Reich, 2014, Popov and Rocholl, 2015, Hochfellner et al., 2015, Bentolila et al., 2017, Benmelech et al., 2019, Greenstone et al., 2020, Benmelech et al.,

[6]Surveys of this literature appear in Matsa (2018), Pagano (2020), Guiso and Pistaferri (2020) and Nishesh et al. (2024). The idea that firms insure their workers against labor productivity shocks goes back to Knight (1921). Guertzgen (2014) analyzes this insurance based on German data. We know of no analysis based on Austrian data.

[7]These are the labor productivity shocks induced by snow shocks that occur during the starting weeks of the ski season. Shocks to labor productivity are in general one of the major types of economic shocks caused by the weather (Addoum et al., 2023). In our setting, these shocks result from weather-induced demand shocks (Starr-McCluer, 2000).

[8]There is a consensus that, due to these labor costs, firms reduce their financial leverage (Simintzi et al., 2015, Serfling, 2016, Favilukis et al., 2020, Kuzmina, 2023). On the asset side, firms adjust their cash holdings (Ghaly et al., 2017) and hedging positions (Brinkmann, 2024).

[9]For a seminal contribution, see Peek and Rosengren (2000). A review of the early literature appears in Thakor (2014). For a recent contribution, see Acharya et al. (2021). They document a range of non-desirable effects of bank under-capitalization, but not regarding the risk-taking capacity of non-financial firms.

2021). We add evidence regarding a specific mechanism - the interaction of labor productivity risk with financial frictions - which is a highly important topic in macro-finance, e.g. in Quadrini (2017) and Arellano et al. (2019).

Our setting is not suitable for identifying effects of the "bank liabilities channel" through which bank capitalization affects employment in Quadrini (2017). Instead, the results in the final part of our paper point towards an effect that is based on a credit channel. With these results, our paper contributes to a small literature on bank behavior when borrowers are hit by weather-induced cash flow shocks.[10] Brown et al. (2021) provide the first evidence that firms use credit lines to cope with "pure" cash flow shocks due to abnormally severe winter weather. We obtain a complementary result when we find that weather (snow) shocks in ski resorts affect the interest income of the nearby banks, but we also show that this effect is modulated by bank capitalization.[11] Our result seems to be inconsistent with evidence in Giroud et al. (2011) that Austrian banks are not willing to write off debt when ski hotels become financially distressed due to a lack of snow in the nearby resorts. The latter evidence, however, comes from data about a small sample of financially distressed ski hotels, while the analysis in the present paper is based on data about the population of ski tourism businesses in rural Austria.

2 The Austrian ski tourism industry

The economy of Austria is largely sustained by bank-dependent, family-owned businesses (54% of all firms and 67% of workers in private enterprises, see Haushofer (2013)). This is true also for its ski tourism industry: Austrian ski tourism businesses are typically small, family-owned firms[12] which rely on local banks for financing, using real estate as collateral. We now describe these firms using data we obtained from a bank which is particularly well-positioned to observe the firms: the Austrian Tourism Bank OeHT.

This bank is a development bank chartered with supporting tourism in rural Austria. Due to banking secrecy regulations, the OeHT cannot share customer-level data. Instead, it provided us with aggregated balance sheet data about tourism firms (aggregated tourism data, ATD) at the municipality-year (MY) level. The data include mean values for levels and growth rates of key balance sheet variables. Data are available for all MYs where the

[10]We distinguish this literature from a literature on natural disasters which typically affect the value of collateral assets for bank loans (e.g. Schüwer et al., 2019, Koetter et al., 2020, Rehbein and Ongena, 2022).

[11]This adds to a literature on bank liquidity creation which has found effects of bank capitalization, but without focusing on banks' provision of liquidity to borrowers hit by cash flow shocks. See Bouwman (2019) for a recent survey. Evidence for effects of bank capitalization and bank size on banks' liquidity creation appears in Berger and Bouwman (2009), Cornett et al. (2011), and Berger et al. (2016).

[12]Dörflinger et al. (2013) reports that family-owned firms make up 93% of the Austrian hotel industry.

OeHT's records allow for averaging at least three observations, counting only those with non-missing growth rates for operating revenue, interest expenses, and short-term debt. While this criterion would allow for constructing data for 93 municipalities, only 70 of those satisfy the criteria we use in our main analysis to select municipalities in ski resorts.[13] These 70 municipalities are included in the data with 163 MYs. Our main analysis covers 410 municipalities, using social security data about their population of tourism businesses.

We begin by using the ATD to describe a typical customer of the OeHT. Table 1 summarizes the key variables. For now, we focus on the variables' overall means, but we also report means for two groups of MYs distinguished by below- or above-median equity capitalization of a municipality's banks. This sample split will be discussed below.

The data shows that an average firm has an operating revenue of approximately 1.7 million Euros, with a wage bill of about 350 thousand Euros and interest expenses of roughly 88 thousand Euros. The wage bill will typically include wages received by members of the firms' owner families. Total debt amounts to approximately 3.4 million Euros on average, including about 520 thousand Euros in short-term debt.[14] Short-term bank debt accounts for around 140 thousand Euros and bank deposits are on average about 104 thousand Euros.

While most of the firms' long-term debt comes from bank loans, their short-term debt includes non-bank debt owed to the Austrian Social Security System, suppliers, landlords, or the owner-family. The debt owed to the Austrian Social Security System typically arises from Austria's system of financing workers' social security and health insurance through cost-sharing between employees and their employers. Debt owed to suppliers is usually rather limited because the businesses are service-sector firms whose primary input is labor. Debt owed to landlords, however, can be substantial, since many businesses operate in valuable real estate. Often, this real estate is only formally separated from the firms, as it frequently belongs to the firms' owners (who prefer this separation because it allows for more flexibility in using the real estate as collateral for bank loans).[15] The firms' obligations to landlords are, therefore, often obligations to their (extended) owner families.

Below, we use the ATD to examine whether the housebanks of ski tourism businesses provide liquidity support to these businesses when they face weather-induced demand shocks. Before presenting this evidence, we discuss more broadly how weather risk affects Austrian ski tourism businesses and their policies.

[13]There must be at least one ski lift and the population must be smaller than 20.000. See Section 4.1.

[14]Total bank debt refers to the total amount a firm owes to banks, which generally includes obligations to banks other than the OeHT.

[15]Consequently, owners are often personally liable for their firms' debts. A case like this is described in Giroud et al. (2011).

2.1 Weather risk and employment

In ski tourism, weather risk is primarily a risk of demand shocks. Evidence of these shocks appears in Töglhofer et al. (2011). Their findings indicate that an unexpected change in a ski season's snow conditions by one standard deviation leads to a 0.6-1.9% change in the number of overnight tourist stays. This result likely understates the effects of snow shocks during the starting and ending weeks of the ski season because it also comes from data about the high-season weeks (when tourists' overnight stays are mostly determined by capacity constraints of ski tourism businesses).

Since snow risk triggers demand shocks in ski resorts, it naturally also impacts employment in ski tourism as an industry where demand directly affects labor productivity. Table 2 reports summary statistics for two types of employment and three parts of the ski season: the season's starting weeks, the high-season weeks starting with the Christmas holidays and the ending weeks after the school holidays in February.

The statistics reveals that employment in ski tourism exhibits strong seasonal variation, driven by the hiring and dismissal of seasonal workers. Employment in the first 4-8 weeks of the season is increasing and reaching a peak; this peak employment is slowly decreasing in the after-season; around half of employees comprises seasonal workers - those employed exclusively during the skiing season.

In our empirical analysis, we will focus on this seasonal employment, as it closely reflects ski tourists' demand for accommodation and typically excludes employees from the firms' owner families. Given the close association between demand and the seasonal employees' productivity, we can use measures of snow risk to convincingly measure labor productivity risk. We are particularly interested in snow risk during the starting weeks of the ski season. In these weeks, the risk is a risk of transitory shocks to labor productivity and the seasonal employment in ski resorts does not respond to the shocks. (This will be shown below.) By analyzing this employment, we aim at uncovering a mechanism which should also affect other (non-seasonal) types of quasi-fixed employment. For further discussion, see the concluding section. Seasonal employment is actually also directly relevant at the macro level because it contributes substantially to many countries' overall employment.[16]

The following section discusses the most important institutional details of risk management and employment in the ski tourism industry.

[16]Del Bono and Weber (2008) show that seasonal employment in Austria is comparable to Canada, which has one of the highest shares of seasonal employment. In terms of employment spells, they identify 21% as seasonal (blue-collar workers across all industries).

2.2 Institutional details

Risk management: Regarding demand risk, the tourism industry primarily manages uncertainty through its pricing and cancellation policies. While booking platforms now offer hotels flexibility in adjusting prices, such platforms were uncommon during our sample period.[17] Instead, most hotels set prices before the ski season, typically specifying a high-season and an off-season rate at which tourists would typically book months in advance,[18] knowing that the bookings can be canceled subject to the hotels' cancellation policies.

These policies, established by the Austrian Hotel Association, are the industry's main risk-management tool. The cancellation fees have remained unchanged for decades. The 2006 fee schedule, still in effect, is shown in Figure A.1 in the Online Appendix. It suggests that accommodation demand in a given week should depend on tourists' snow expectations one week prior to arrival since during the last week cancellation fees are higher by 20%.

In addition to managing weather-related demand shocks through pricing and cancellation policies, tourism businesses can mitigate their exposure by investing in amenities (e.g. wellness facilities) that reduce the impact of snow shortages on tourist demand. Our research strategy accounts for such factors, as discussed in Section 3.

Explicit weather insurance appears to be limited to specific events like ski races. Since we focus on the starting weeks of the ski season, it is reasonable to assume that ski races have minimal influence on our estimates.

Employment contracting: Next, we examine the ski tourism businesses' contracting with their workers. As noted earlier, seasonal workers make up the majority of the workforce during the ski season. Under Austrian labor law, these workers, known as "Saisonniers", typically sign fixed-term contracts with the firms. To be valid, such a contract must specify both a start and end date, as well as the worker's weekly hours and monthly salary. Fixed-term contracts are so commonly used because they allow employers to avoid the need for a notice period when laying off workers at the end of their term. However, it is illegal for a firm to terminate a seasonal worker before the worker's contract expires.

Hiring is typically implemented well in advance of the start of the ski season to allow workers to relocate; in particular for foreign workers, which comprise a large part of these seasonal workers. Hiring workers on short notice is constrained by local labor market tightness, as most Austrian ski resorts are situated in areas with low population density and small

[17]For example, Booking.com, founded in 1996, began operating in Austria only in week 27 of 2006, near the end of our sample period. Google Trends data shows zero traffic in Austria before that date. In 2003, online travel sales accounted for just 5.5% of total European travel sales (Eurostat, 2006).

[18]Even in 2015, 66% of Austrian hotel bookings were made over a month in advance (WKO, 2016). This rate was likely higher in ski resorts due to fewer last-minute bookings by business travelers.

labor markets. The end dates of the seasonal contracts are often set before the likely end of the ski season, as it is relatively easy for both firms and workers to extend their employment relationships by mutual agreement.

2.3 Risk-sharing with banks

We conclude our discussion of the Austrian ski tourism industry by presenting evidence that businesses in the industry share the risk of snow shocks with their housebanks. The evidence is based on the aggregated tourism data (ATD) on customers of the Austrian Tourism Bank (OeHT). Since this sample is not representative, we only use it to motivate our main analysis. In both analyses, we focus on the starting weeks of the ski season in order to measure effects of transitory demand shocks.

Figure 1 presents four bar charts, each displaying the average growth of a key balance sheet variable across four groups of municipality-years (MYs). The MYs are first divided into two groups based on whether local banks have a below- or above-median equity ratio. Each of these groups is then further divided according to whether snow shocks during the starting weeks of some year's ski season were negative or positive. The variables used for these splits are defined in Section 4.2. For now, it suffices to note the column labels: "Low BE" and "High BE" denote low and high bank equity (BE) capital, while "Neg UES" and "Pos UES" indicate negative and positive unexpected snow (UES), respectively.

Our primary focus is on comparing the within-group variation observed in the MY groups with Low BE and High BE. To capture this variation, we measure all growth rates relative to their municipality-level means by regressing the raw growth rates on municipality fixed effects. Since the raw growth rates are averages of firm-level growth rates at the MY level, these regressions are frequency-weighted by the number of firm-level observations contributing to each average (using observation counts which are included in the data the OeHT provided to us). The regressions' residuals are growth rates centered at the municipality level. The bar charts depict frequency-weighted averages of these centered growth rates, illustrating variation driven by negative or positive UES.

To test whether the MY groups with Low BE and High BE differ in terms of within-group variation, we add dummies to the regressions that generate the centered growth rates: one for High BE status, one dummy for Pos UES status, and their interaction term. If the p-value of the interaction coefficient is below 5 percent, this will be mentioned in the following discussion of the growth rates' (within-group) variation across MYs with Low and High BE.

The levels of the balance sheet variables in the two groups of MYs are compared in Panel B of Table 1. While there are various statistically significant differences, only two of those are economically significant: We observe both more short-term bank debt and more bank deposits in the groups with Low BE status than in those with High BE. This suggests that, in MYs with Low BE, firms' short-term borrowing creates deposits. Of course, we only have data about the firms' bank deposits, but we cannot observe the owners' personal holdings of bank deposits.

Operating revenue: The bar charts in the top left panel of Figure 1 show operating revenue growth. We find no statistically significant difference between the groups with Low BE and High BE regarding the extent of within-group variation observed in MYs with positive and negative UES. The small extent of the within variation in both groups is not surprising, because the groups are split based on UES in the starting weeks of the ski season, which account for only a small portion of the businesses' annual operating revenue. Given the means for operating revenue reported in the two groups' columns in Panel B of Table 1, the observed growth rates imply differences in mean operating revenue of about 15 thousand Euros in the Low BE groups and 36 thousand Euros in the High BE groups.

Interest expense: The top-right bar chart displays interest expense growth rates. In the Low BE groups, variation in interest expense growth is minimal and statistically insignificant. In contrast, the High BE groups exhibit significant variation both in absolute terms and relative to the Low BE groups. On average, the High BE groups' interest expense growth differs by approximately 4 percentage points across the MYs with Neg UES and Pos UES, which translates into to a variation of about 3.6 thousand Euros, given the mean interest expense of about 89 thousand Euros reported in Table 1.

Short-term borrowing: The lower half of Figure 1 presents two bar charts related to tourism businesses' short-term borrowing from banks. The first chart shows growth rates for short-term bank debt, while the second chart depicts how these growth rates deviate from operating revenue growth. The latter chart addresses the concern that changes in short-term bank borrowing should partly reflect changing working capital needs.

Both bar charts display relatively little variation for the groups with Low BE, and this variation is statistically insignificant in both cases. In contrast, the High BE groups exhibit more substantial variation, which also differs in a statistically significant way from that observed in the Low BE groups. To express this variation in terms of Euro amounts, we can relate it to the mean of short-term bank debt in the High BE groups, - an amount of about 120 thousand Euros, reported in Table 1. Given this number, the High BE groups' within-variation in the growth of short-term bank debt amounts to an increase of about

12 thousand Euros. This amount far exceeds the 3.6 thousand Euros of interest expense reduction mentioned above. This suggests that we are not simply observing a consequence of banks allowing firms to convert interest obligations into short-term debt. Put differently, we observe evidence that the firms receive new capital. All in all, the increase in short-term bank debt amounts to about one third (12/36) of the reduction in operating revenue mentioned above.

Figure A.2 in the Online Appendix presents additional bar charts, concerning the growth of firms' wages and bank deposits. Interpreting these bar charts is difficult because many firms' wage bills will include wage payments to members of their owner-families and such payments also directly link the firms' bank deposits to those of their owners (unobservable). Both wage growth and bank deposit growth are higher in MYs with positive UES than in those with negative UES, in particular in the groups with Low BE. The within-variation in these groups is, however, not significantly different from that in the High BE groups.

We conclude that the aggregated firm-level balance sheet data show effects of UES on firms' financing and interest expenses, and that the effects depend on the capitalization of firms' nearby banks. This evidence motivates the central hypothesis we test in our main analysis, using social security data about the population of ski tourism businesses in rural Austria: that firms' access to well-capitalized banks affects the sensitivity of their employment to labor productivity risk. This hypothesis includes a notion of banks being "special" in that they provide a service which non-bank creditors cannot provide as efficiently, - helping firms to address liquidity needs due to demand shocks.

3 Research strategy

Our analysis uses panel data tracking weekly employment at the firm-level.[19] We first analyze how this employment responds to snow conditions in ski resorts as an exogenous driver of labor productivity. We find that snow conditions affect the employment during the ending weeks of the ski season, but not during the starting weeks. The latter (null-)result aligns with the notion that employment is quasi-fixed with respect to transitory shocks to labor productivity, given that during our sample period, early-season snow shortages were almost certainly temporary.

Regressions explaining wages yield further evidence for the quasi-fixity of employment in ski tourism during the ski season's starting weeks. Our main regressions, however, analyze how the employment responds to snow risk. We test the hypothesis that the effect of snow

[19]See Dell et al. (2014) and Auffhammer (2018) for discussions on using panel data to address identification issues related to the effects of weather on economic decision making.

risk depends on the capitalization of firms' nearby banks. As discussed above, this hypothesis views bank capitalization as a determinant of firms' access to credit they need when (weather-induced) demand shocks keep their employees from "earning their pay."

The key explanatory variable of our main regressions is a measure of snow risk, interacted with a (de-meaned) proxy for the equity capital of a firm's nearby banks:

$$\ln(ED_{i,\tau,t}) = \beta_0 SR_{j(i),\tau,t} + \beta_1 SR_{j(i),\tau,t} \times BE_{j(i),t} + \gamma Z_{i,\tau,t} + \alpha_{i,t} + \alpha_\tau + \epsilon_{i,\tau,t}, \tag{1}$$

where t indexes years (ski seasons), τ indexes calendar weeks of the ski season (e.g., the week before Christmas), i indexes firms in ski resort municipality $j(i)$, $ED_{i,\tau,t}$ denotes person-days of employment ("Employment Days"), $SR_{j(i),\tau,t}$ denotes Snow Risk, $BE_{j(i),t}$ measures the equity capital of the banks with branch offices close to the municipality $j(i)$, and $Z_{i,\tau,t}$ denotes control variables. Section 4.2 defines all variables. To mark these variables in the text, we use capital letters, e.g., referring to the variable $BE_{j(i),t}$ as Bank Equity or BE.

The regression in (1) contains two types of fixed effects, $\alpha_{i,t}$ and α_τ, at the levels of firm-years and calendar weeks, respectively. The firm-year fixed effects control for changes in a firm's exposure to snow risk (SR) resulting from upgrades to its fixed assets (e.g., buildings or spa areas) or investments in regional ski tourism infrastructure. These upgrades will typically happen between firm-years since construction projects are typically scheduled during the off-season. The week fixed effects control for variation in employment caused by seasonality which is not necessarily due to variation in SR. For example, the surge in tourist arrivals during the Christmas holidays typically leads to a faster rise in employment in the week prior, relative to other weeks of the ski season.

The regression exploits variation in SR coming from shifts in snow patterns due to a warming climate in the Austrian Alps. We document these shifts in regressions that appear in the Online Appendix. These regressions show that, during the early weeks of the ski season, SR increased in ski resorts at higher levels of altitude relative to those at lower altitudes. We measure how these shifts in SR affect employment while allowing for different effects in municipalities with different levels of BE. Given that our measure of BE is de-meaned, the coefficient β_0 is a credible measure of the baseline effect of SR that can be used to measure the economic significance of variation in BE in terms of the ratio β_1/β_0. This ratio and, in particular, the coefficient β_1 are our main estimates.

Having explained the regression mechanics, we now illustrate how the previously discussed shifts in SR interact with BE. Figure 2 presents maps of Austria, color-coded to highlight regions with particularly high and low variation in SR throughout the years of our sample period. Given that our main regressions concern the starting weeks of the ski season (when employment in ski tourism is quasi-fixed), the color-coding is based on shifts in SR during these weeks, estimated using the regression reported in column 7 of Table A.1 in the Online Appendix. We show separate maps for ski resorts with below-median and above-median Bank Equity. The maps reveal a relatively even distribution of variation, with dots of both colors appearing in all five Austrian states traditionally associated with ski tourism: Vorarlberg, Tyrol, Salzburg, Carinthia, and Styria (from west to east).

We next discuss identification. Exogeneity of SR ensures that the coefficients β_0 and β_1 can be consistently estimated (even if BE is an endogenous variable; see Nizalova and Murtazashvili, 2016), but we must address identification problems to specifically measure how BE affects the sensitivity of employment to labor productivity risk. One problem is that, in the chain of causation leading from SR to employment via labor productivity risk, BE may proxy for heterogeneity in the strength of the first link. As a consequence, β_1 may be measuring not only how employment responds to labor productivity risk, but also how this risk is driven by SR. For instance, high BE may increase the availability of credit for investments that mitigate the impact of snow shocks on ski tourism demand and labor productivity.[20] Reverse causality is a related concern: banks operating near ski resorts where demand is more sensitive to snow conditions may rely more on equity financing because tourism businesses among their borrowers face a higher risk of financial distress.

To address the identification challenges, we use an instrumental variable for BE. This variable is based on the observation that the Austrian banking system features a large number of small, yet independent banks without direct access to public capital markets. These banks operate mainly in rural areas, with branch networks that are highly geographically concentrated. To obtain capital and funding, they use non-public capital markets which connect each of them to one of three banking groups, i.e., the group of the savings banks (Sparkassen), and two groups of cooperative banks (Raiffeisenbanken and Volksbanken).

Our instrument exploits market segmentation in the internal capital markets of the banking groups. It is motivated by the notion that a group's banks within the same Austrian state are more directly connected to each other than they are to other states' banks of the same group. The instrument measures the capitalization of the banks to which a certain bank is only *indirectly* connected: the banks in the same group which operate in other Austrian states. The resulting measure of bank capitalizations should proxy for a bank's ability to obtain support from its wider group if the bank faces a situation of (verifiably) exogenous

[20]The most apparent investments for mitigating snow risk involve infrastructure for generating artificial snow in ski resorts. Although our data cover a period in which this infrastructure was largely absent, the identification issue still applies to firm-specific strategies for stabilizing cash flow. For instance, some ski hotels attract guests with spa areas, offering an alternative form of leisure unrelated to skiing — a strategy that may be more prevalent in areas with well-capitalized banks.

financial distress due to a weather shock hitting many of the bank's borrowers. It excludes data about a bank's direct "neighbors" since it is likely that these banks also cooperate in their more regular business. In Austrian ski regions, this business should be strongly driven by the investment needs of the local tourism industry, including those aimed at reducing the industry's exposure to weather-induced labor productivity risk.

We use the instrument in regressions where the endogenous variable is the bank capitalization (BE) of the banking groups' member banks operating in Austrian ski resorts. Our setting actually allows for analyzing the validity of our instrument, using data on tourists' overnight stays to inspect the first link of the chain of causation leading from SR to employment via demand/labor productivity risk. This is possible because the Austrian Statistical Office publishes tourism data for winter and summer tourism. We use the data for the winter season to test whether our instrument explains the sensitivity of tourists' overnight stays to snow shocks. This test, described below in Section 5.2.2, yields evidence that the instrument works as intended.

4 Data and main variables

4.1 Sample selection

Our main sample results from the Austrian Social Security Database (Zweimüller et al., 2009). We begin with the entire set of employment spells in the Austrian tourism sector between 1977 and 2011 (10,316,391 spells). Of these, 47.5% are spells in ski tourism which satisfy two criteria:

1. The tourism business must be in a municipality with at least one ski lift, excluding cities (population > 20,000) that tend to attract business travelers.[21]

2. The employment spell must start after November 1 and end before May 1 of the following year. By using this relatively broad time window, we ensure that we also capture spells that begin just before or end just after the ski season. To select an appropriate window we follow the literature. There, the ski season is typically defined as November-April (Töglhofer et al., 2009, Steiger and Abegg, 2013, Kotlarski et al., 2023).

We match the social security (employment) data with snow data and balance sheet data from Austrian banks. Below, we formally define the variables we create using the three data sources. The key variable for merging the data is a municipality ID describing employer location in the social security data, - a five digit code according to the Nomenclature of

[21]We use the following list of ski lifts: `https://de.wikipedia.org/wiki/Liste_der_Skigebiete_in_%C3%96sterreich`.

Territorial Units for Statistics (NUTS). Snow data and banking data are assigned to the employer location using data about the locations of ski lifts and bank branches, respectively.

4.2 Main variables

Employment: To measure a firm's employment, we first define two indicator variables. The first, denoted as $I_{w,i,d}$, indicates whether worker w was employed by firm i on calendar day d. The second, $ES_{w,i,t}$, is an indicator variable showing whether the employment spell between worker w and tourism firm i in year (ski season) t is an employment spell in ski tourism, as defined above. The product of these two indicator variables sums to a firm-week level measure of employment:

$$\text{Employment Days } ED_{i,\tau,t} = \sum_{d \in \mathcal{D}(\tau,t)} \sum_{w} ES_{w,i,t} I_{w,i,d}, \tag{2}$$

where τ indexes weeks, t indexes years (ski seasons), and $\mathcal{D}(\tau, t)$ is the set of calendar days in a particular week. The above-stated variable is the dependent variable of the regression in expression (1).

For a subsample of the employment spells included in our measure of Employment Days, we can also measure the average daily wage received by the employees. The requisite data are available for a sizable set of employment spells because the Austrian social security data include annual labor income, broken down by the employers a person worked for during a given year. We use the data to calculate the average daily wage paid by a firm i during the weeks of the ski season before some year t's end, focusing on spells in ski tourism ($ES_{i,w,t} = 1$) which are unique observations of worker w being employed by firm i in year t:

$$\text{Daily Wage } DW_{i,t} = \left(\sum_{w} US_{w,i,t} W_{w,i,t} \right) / \left(\sum_{w} US_{w,i,t} \sum_{Nov1 < d < Dec31} I_{w,i,d} \right), \tag{3}$$

where the numerator is the sum of the wage income $W_{w,i,t}$ that firm i paid to any worker w in an employment spell for which $US_{w,i,t} = ES_{w,i,t} U_{w,i,t} = 1$, where U is a dummy equal to one if the employment spell between worker w and firm i in year t is unique. The denominator is the total of the person days of the unique employment spells.

Snow variables: Snow data come from the Austrian Meteorological Office (AMO), which provided 1×1 km grid data with daily snow depth information. The data source is a snow cover model (Schöner and Hiebl, 2009) that incorporates air temperature, precipitation, and geospatial variables describing the topography of ski resorts. The model generated natural snow data for the years 1978-2006. The 2006 cut-off is due to data unavailability since 2006 is the final year the model was used to produce snow maps (Schöner and Hiebl, 2009). Extending the sample period would, however, yield little benefit since Austrian ski resorts increasingly rely on artificial snow, but the AMO's data concerns natural snow levels.

We match the snow data to municipalities based on the coordinates of ski lifts within a 10-kilometer radius around the geographic center of a municipality's area. Figure A.3 in the Online Appendix illustrates this process for Lech am Arlberg, a well-known resort in the Austrian state of Vorarlberg. The 10-kilometer radius defines a region in which we average the snow levels closest to the center of any ski lift in the region. This yields a measure of the average snow levels for each ski resort on each day of the sample period. Using this measure, we identify weeks with conditions suitable for skiing, defining a snow-week indicator equal to one for weeks in which the average snow level exceeded 15cm on a majority of days. In choosing the 15cm cutoff, we follow Giroud et al. (2011).

In our empirical analysis, we distinguish between two types of information about the snow conditions in ski resorts, i.e., information available well before the start of a ski season, and "news" arriving during the season. The first type of information includes, for each calendar week, the expected snow conditions and a measure of snow risk. Both variables are measured using the snow data for the same week τ and resort j in the five years before any given year t:

$$\text{Expected Snow } ES_{j,\tau,t} = \frac{1}{5}\sum_{n=1}^{5} \text{Snow Week}_{j,\tau,t-n}, \tag{4}$$

$$\text{Snow Risk } SR_{j,\tau,t} = \frac{1}{5}\sum_{n=1}^{5} (\text{Snow Week}_{j,\tau,t-n} - \text{Expected Snow}_{j,\tau,t})^2. \tag{5}$$

The second variable is the main explanatory variable of the regression in expression (1) while ES is used as a control variable, included in $Z_{i,\tau,t}$.

We next define our measure of snow "news". This is the difference between the snow-week dummy and ES, defined above:

$$\text{Unexpected Snow } UES_{j,\tau,t} = \text{Snow Week}_{j,\tau,t} - ES_{j,\tau,t}. \tag{6}$$

This variable will be used to test whether snow news/shocks affect firm-level employment during specific weeks of the ski season.

Bank capitalization: Balance sheet data on Austrian banks are available from the Austrian Central Bank (OeNB). The data, starting in 1998, include unconsolidated balance sheets for all banks operating in Austria. To link this information to ski resort municipalities, we use OeNB data on Austrian banks' branch networks. We identify all bank branches located within a 20-kilometer radius around the geographic center of municipality j, denoted as the set $\mathcal{B}(j)$. We choose this radius given evidence that 90% of US small businesses use banks within 14.8 miles from their locations (**?**), which corresponds to about 20 kilometers.

We refer to the banks in the set $\mathcal{B}(j)$ as municipality j's local banks. Given this set, a natural basic definition of municipality j's average bank equity ratio is:

$$\text{Bank Equity } BE^{all}_{j,t} = \sum_{b \in \mathcal{B}(j)} \frac{m_{j,b,t}}{M_{j,t}} \times \frac{\text{Total Equity}_{b,t}}{\text{Total Assets}_{b,t}}, \tag{7}$$

where the second ratio measures the equity ratio of bank b in year t and the first ratio is the bank's "market share", given by the number of its branches in the set $\mathcal{B}(j)$ divided by the total number of bank branches in this set: $m_{j,b,t}/M_{j,t}$.

The above-stated expression defines our baseline measure of bank capitalization, which we use in bar charts and in OLS regressions explaining employment. This measure is, however, not suitable for our IV regressions, because these regressions use an instrument for the capitalization of a subsample of banks, - the member banks of three banking groups: the group of savings banks (Sparkassen), and two groups of cooperative banks (Volksbanken and Raiffeisenbanken).

To avoid within-group competition, the banking groups' members focus their operations on different areas in Austria, with branch networks limited to these regions. We therefore refer to the three groups' member banks as "regional" banks. Using only these banks' balance sheet data, we construct two further measures of bank capitalization. The first is a measure like that in expression (7), but restricted to the regional banks:

$$BE^{reg}_{j,t} = \sum_{b \in \mathcal{R} \cap \mathcal{B}(j)} \frac{m_{j,b,t}}{M^{reg}_{j,t}} \times \frac{\text{Total Equity}_{b,t}}{\text{Total Assets}_{b,t}} \tag{8}$$

where $\mathcal{R}$ is the set of regional banks and $M^{reg}_{j,t}$ denotes the number of branches operated by regional banks in the area $\mathcal{B}(j)$.

Our final measure of bank capitalization is the variable we will use as instrument to obtain our IV estimates. It differs from that defined in the last expression in that we replace the measures of bank b's total equity and total assets by their averages across the banks in bank b's group ($grp(b)$) outside of bank b's state ($s(b)$):

$$BE_{j,t}^{grp} = \sum_{b \in \mathcal{R} \cap \mathcal{B}(j)} \frac{m_{j,b,t}}{M_{j,t}^{reg}} \times \frac{\text{Total Equity}_{b,t}^{grp(b)-s(b)}}{\text{Total Assets}_{b,t}^{grp(b)-s(b)}}. \tag{9}$$

Given its definition, the instrument defined in expression (9) is based on 21 different measures of bank capitalization across the banking groups and states (3 groups of banks times 7 Austrian states with ski resorts). It can be seen as a leave-one-out measure, but instead of leaving out individual banks, we leave out all banks in a given bank's group and Austrian state (including the bank itself). The resulting variable will, by construction, pick up shifts in aggregate bank capitalization.

Figure A.4 in the Online Appendix plots means of changes in our instrument across the years 1998 (the first year for which we can get bank balance sheet data covering all Austrian banks) and 2006 (the last year of our snow data). The lines running through the diagram marks the overall mean (across the years) and the confidence interval around this mean.

The overall mean is positive, showing that the Austrian regional banks made more use of equity financing at the end of the sample period than at the start. We, however, also see a number of disruptions of the capital buildup, most notably in the years 1999, 2003 and 2005. A likely reason for these disruptions is a process of massive foreign direct investment (FDI) by Austrian banks, targeting countries in the former Soviet Union. This process involved both greenfield investments and acquisitions of foreign banks, many of which actually occurred in 2003 and 2005.[22] It is, unfortunately, impossible to more closely track the effects on individual banks because the funding of the FDI process was highly non-transparent, typically involving many non-listed banks.[23]

Tourists overnight stays: Administrative data about tourists' overnight stays (TS) will be used in a test of the validity of our instrument for BE. The data are available from the Austrian Statistical Office (Statistik Austria). The level of variation is the municipality-year,

[22]For example, the Sparkassen (savings banks) group invested approximately 4 billion euros to acquire banks such as BCR (Romania) and Postabank (Hungary) while the Raiffeisen group invested about 1 billion euros to acquire institutions such as the Bank Aval (Ukraine). See the list in `https://de.wikipedia.org/wiki/%C3%96sterreichisches_Bankwesen#Expansion_nach_Ost-_und_Zentraleuropa_(seit_1990er)`, visited March 27, 2025.

[23]A notable exception are two seasoned equity offerings (SEOs) through which the lead savings bank, Erste Bank, raised external capital needed not only to finance new acquisitions, but also to refinance earlier FDIs made by its main owner, the Anteilsverwaltungssparkasse (AVS), - a legal vehicle through which the Austrian savings banks collectively own a share in Erste Bank AG. These SEOS were in the years 2000 and 2002 and raised more than 800m Euros, freeing up capital that the savings banks had invested before to fund the acquisition of the main Czech savings bank. See `https://www.derstandard.at/story/979128/erste-bank-beschliesst-kapitalerhoehung-von-600-millionen-euro`, visited March 27, 2025.

but separate data are available for two six month periods: summer and winter. We use data on TS during the winter, measuring the first difference of log overnight stays, $\Delta log(TS_{j,t})$.

4.3 Summary statistics and long-term trends in snow risk

We next discuss the descriptive statistics of our main variables, reported in Tables 1 and 2. The first table concerns the variables which vary across years, while the second concerns the variables for which we have weekly data.

The annual data are two types of balance sheet data. Panel A of Table 1 presents bank balance sheet data concerning the population of Austrian banks: 5966 banks, of which 4399 banks are member banks of the savings banks group (Sparkassengruppe) or the two groups of cooperative banks (Raiffeisen, Volksbanken). The summary statistics concern the measures of bank capitalization defined in expressions (7) - (9), which vary at the MY level. All measures show a mean close to 800 basis points. This is not surprising because, under “Basel I” regulation, banks had to hold equity capital of at least 8% of their risk-weighted assets. The measures are, however, very different in terms of the extent of variation between and within MYs: By construction, the measure based on the aggregate equity capital of the banking groups shows much higher within- than between-variation.

Panel B of Table 1 shows summary statistics for the aggregated tourism balance sheet data, including the sample split already discussed in Section 2.3. This sample split is based on our measure of baseline BE (expression 7) and its median in the employment data. This cut-off actually results in somewhat differently sized groups when we apply it to the sample of MYs for which we have aggregated tourism balance sheet data. We tolerate this problem for comparability of our tests and bar charts using different types of data. In terms of mean (baseline) BE, the two groups of MYs differ by 174 basis points, given the sample of MYs included in the employment data.

Table 2 reports descriptive statistics for our main dependent variable (Employment Days ED, defined in expression (2)) and for the underlying number of employees. These statistics are based on a total of 323,685 employment spells involving 16,801 employers and 126,743 employees. We report separate statistics for the high-season weeks of the ski season, as well as for the season’s starting and ending weeks. The starting weeks are the four weeks 47-50 of the calendar year in which a season starts. These weeks lead up to the start of the high season, - the Christmas holidays. The ski season’s ending weeks are the four weeks 11-15 of the following calendar year.

The three types of weeks differ substantially not only in the averages of the two variables, but also in the type of variation. We report separate measures of the variables’ variation between and within firm-years. In the high-season weeks, the within-variation is much smaller than the between-variation because the tourism businesses tend to be booked out during these weeks, so that their employment is largely determined by capacity constraints which do not vary within firm-years.

With respect to the snow variables, we report descriptive statistics for the variables defined in expressions (4) and (5), as well as the underlying indicators for snow weeks and snow days, - the count of days in a week with more than an average 15cm of snow cover in the ski resorts. While the latter two variables are based on the entire period for which we have snow data (1978-2006), our main snow variables, Expected Snow (ES) and Snow Risk (SR), can only be measured over the period 1983-2007 because each data point of these variables is based on 5 years of snow data.

In the Online Appendix, we trace the variation in ES and SR to long-term trends: Table A.1 reports regressions showing that ES decreases over time while SR increases. The former trend is stronger in ski resorts at lower altitude levels while the latter trend is stronger at higher altitudes. If we focus on the starting weeks of the ski season, there actually are no significant trends in ES and neither a significant effect of altitude, but we do find a pronounced positive trend in SR at higher altitudes. This is intuitive: with global warming, SR increases in high-altitude ski resorts in which this risk used to be negligible even during the starting weeks of the ski season. This heterogeneity is clearly visible in Figure 2, which results from the estimates in column 7 of Table A.1 and depicts a median split of the ski resorts based on the trend in SR during the ski season's starting weeks. The ski resorts featuring above-median increases in SR tend to be closer to the main ridge of the Alps.

5 Main results

5.1 Exploratory analysis: Quasi-fixity of employment

As discussed earlier, our analysis focuses on the starting and ending weeks of the ski season, — periods when ski tourism businesses are not fully booked. We estimate separate regressions for these two periods, with results presented in Table 3. The regressions examine how Employment Days ($ED_{i,t,T}$, defined in expression (2)) respond to Expected Snow ES and Snow Risk SR (defined in expressions (4) and (5)) as well as Unexpected Snow UES, where the last variable (defined in expression (6)) captures new information about snow conditions emerging after the start of the ski season. Given the level of variation in the explanatory variables, we cluster standard errors at the municipality-year level.

Across all estimates, ED respond significantly positively to ES. However, the most revealing results in Table 3 concern the effects of SR and UES. SR has a significantly negative impact on employment, but only during the starting weeks of the season. In contrast, UES has no significant effect during these weeks but does affect employment during the ending weeks. The latter effect is particularly strong with respect to UES in the same week, compared to lags of UES. This may seem at odds with the earlier discussion that tourists can only avoid substantial cancellation fees if they cancel their hotel bookings at least one week before arrival. However, our estimates may be capturing precisely this effect, as cancellations are likely based on snow forecasts, which are correlated with actual weather and snow conditions in the following week.

During the ski season's starting weeks, we find no significant effects of UES and also a substantially smaller point estimate for the effect which is statistically significant during the ending weeks. We thus see a quasi-fixity of employment which can be interpreted as an outcome of tourism businesses "insuring" their employees against labor productivity shocks induced by a transitory lack of snow and touristic demand. This should be efficient and confirms that firms in developed economies insure their workers against transitory productivity shocks (Pagano, 2020 and in Guiso and Pistaferri, 2020).

In Section 6, we will further analyze this insurance by testing whether UES affects wages in ski tourism. For now, we keep focusing on employment. The results regarding SR show that, during the ski season's starting weeks, the scale of ski tourism employment correlates with pre-season expectations about Snow Risk. For an increase in SR by one standard deviation (0.08, within firm-years), the coefficient in Table 3 implies a drop in ski tourism employment by approximately 2% (0.08 times 0.259). We only observe this effect during the ski season's starting weeks, which suggests that it is an effect concerning quasi-fixed employment. In the season's ending weeks, employment responds to UES, but not to SR.

5.2 Main results: Bank equity, risk, and employment

In this section, we test the hypothesis that bank capitalization influences the extent to which labor productivity risk reduces quasi-fixed employment. We test this hypothesis by focusing on the starting weeks of the ski season, when employment in ski tourism appears to be quasi-fixed. The more employees a firm hires for these weeks, the greater the risk of labor idleness if a temporary lack of snowfall reduces demand. If businesses in regions with higher bank equity capital are more tolerant of this risk, we expect their employment decisions to be less sensitive to snow risk.

5.2.1 OLS estimates

Table 4 presents OLS estimates for regressions that extend those in the second column of Table 3 by incorporating interactions between Snow Risk SR and Expected Snow ES with measures of Bank Equity BE. The baseline effects of BE are absorbed by firm-year fixed effects.

The first three columns present estimates for all of our measures of bank capitalization, defined in expressions (7) - (9). All columns show a negative baseline effect of SR which is comparable in size to that in the second column of Table 3. The coefficients of the interactions of SR with BE are, however, significantly positive.

It thus appears that, at higher levels of BE, employment is less sensitive to Snow Risk. To assess the economic significance of this effect, we estimate the ratio of each column's coefficient of the interaction of BE and SR to the respective column's baseline coefficient of SR. These estimates are reported in the bottom of Table 4 in the row labeled β_1/β_0. They range from 0.5 to 0.9 percent.

We also find a statistically significant effect of BE on the sensitivity of employment to Expected Snow ES, but not for the measure of BE which will serve as an instrument in our IV regressions. This is reassuring, given that the instrument is supposed to remove variation in BE which modulates the effect of the snow conditions on tourist demand in the ski resorts.

The remaining columns of Table 4 present "placebo" checks and robustness checks, focusing on the two measures of bank capitalization we use to obtain our main result through IV estimation. The placebo checks appear in the fourth and fifth column of Table 4. They are based on our data for the ending weeks of the ski season and extend the regression reported in the fifth column of Table 3. While we still find an effect of BE on the sensitivity of employment to Expected Snow, we no longer find a significant effect on its sensitivity to Snow Risk. It thus appears that the latter effect is specific to the starting weeks of the season, when the ski businesses' employment is quasi-fixed. This suggests that the effect is actually rooted in firms having a limited capacity to bear a risk of labor idleness, rather than laying off workers when their productivity drops.

We finally test whether the effect of BE on the sensitivity of the firms' employment to SR is actually due to variation in SR. To test this, we extend our regressions by adding interactions of BE with calendar week dummies to our set of control variables (with week 1 as an omitted category).[24] The resulting estimates appear in the two right-most columns of Table 4. Some of the interactions of BE with calendar week dummies appear with significant coefficients, but we find almost the same point estimates as before for the coefficients of the

[24]We thank a referee for suggesting this robustness check.

interactions of BE and SR.

We conclude this section with a graphical analysis of the effect of BE that shows its economic significance and allows for comparing it to the bar charts in Figure 1. While our regressions measure the effects of SR and BE using continuous variables, the graphical analysis uses these variables for median splits, allowing us to show variation in Employment Days across four groups of observations. The underlying measure of bank capitalization is the baseline measure defined in expression (7). We take the median of this measure across all municipality-years for which we have employment data.

Figure 3 displays the average ED for each group, where the two left-hand bars concern the groups with below-median BE, while the two right-hand bars are for above-median BE. For each of these pairs, we first plot the average ED: The solid line running through Figure 3 shows the average ED for the groups with Low BE, while the dashed line shows this for the groups with High BE. The variation around these means is depicted by the columns of Figure 3, where the first and third column are for the groups with above-median (High) SR while the second and fourth column are for Low SR. We isolate this variation by running the regression in the first column of Table 4, but excluding SR and its interaction with BE. The residuals of this regression are subsequently averaged within each group, and each group's average residual is added to the average ED of the pair the group belongs to.

The bar charts show that SR has a relatively large effect on ED in the groups with Low BE, while the groups with high BE are less affected. The former groups' columns (the two left-hand columns in Figure 3) differ by about 1 ED, while the difference is only about 0.6 ED in the latter groups. The difference-in-difference is about equal to the difference between the dashed and solid lines, which shows the baseline difference between the mean ED of the two pairs of groups.

The bar chart in Figure 3 complements those in Figure 1 which use the same median of BE as the cut-off value defining the Low/High BE groups. Comparing the bar charts shows that, in the High BE group, we observe both a smaller sensitivity of ski tourism employment to SR as well as stronger effects of snow shocks (UES) on firms' interest expense growth and on their short-term borrowing from banks. While the latter results come from data about a selected sample, they suggest that employment is less sensitive to SR in areas with high BE *because* employers in these areas have more opportunity for risk-sharing with their banks.

We next use IV estimates to address the concern that our results regarding employment could come from an effect of bank capitalization specific to our setting.

5.2.2 IV estimates

The OLS estimates in Table 4 reveal that bank capitalization affects the sensitivity of ski tourism employment to SR, but the nature of this effect remains unclear: Given the causal chain leading from SR to employment via labor productivity risk, BE could be modulating either or both causal links. In this section, we specifically analyze whether BE modulates the response of (quasi-fixed) employment to labor productivity/idleness risk - the second part of the causal chain. As discussed in Section 3, this requires an instrument for BE.

We start with an analysis of the validity of our instrument, - the measure of BE defined in expression (9) which results from aggregated data about the total assets and total equity of groups of Austrian regional banks.

Validity of the instrument: Our setting allows for analyzing effects of the weather on a direct proxy for labor productivity: tourists' overnight stays (TS) in ski resorts. We now use this variable to test whether bank capitalization modulates the first link in the causal chain from weather risk to employment via labor productivity risk.

Table 5 presents estimates concerning the effects of snow shocks on TS in ski resorts during the winter season. The dependent variable is the growth of TS between two year's winter seasons. For municipalities in ski resorts, this growth is largely driven by TS during the ski season.

The main explanatory variable is the sum of the weekly snow shocks defined in expression (6), where we sum over the starting weeks of any year's ski season. This yields a measure of Unexpected Snow (UES) which varies at the annual level (like the dependent variable) while keeping our focus on the part of the ski season in which employment in ski tourism is quasi-fixed (in that it does not respond to UES).

The first column of Table 5 shows that UES has a significant effect on TS: An additional snow week during a ski season's starting weeks increases the growth of TS by about 0.4 percentage points. This effect is economically significant given that the starting weeks account for a relatively small fraction of TS. The effect comes from variation around trends captured by fixed effects at the municipality level. If we add year-level fixed effects, we obtain a somewhat smaller point estimate for the effect of UES, with a higher standard error, - reported in the second column of Table 5. This points to a lack of statistical power (and highlights the importance of using intra-annual snow shocks in our main regressions).

The remaining columns of Table 5 report regressions without year-level fixed effects. These regressions test whether the sensitivity of TS to UES correlates with our measures for the equity capital of banks in the ski resorts. If we find a high correlation, Bank Equity BE should also correlate with cross-sectional heterogeneity in the effect of snow risk on labor productivity risk in Austrian ski tourism. In this case, it would be possible that our evidence on employment results from effects specific to our setting, rather than from generalizable effects of labor productivity risk on employment.

We find no evidence for this possibility. The final two columns of Table 5 show that BE is not significantly correlated with the sensitivity of TS to UES. However, we see markedly different point estimates for the two measures of BE we use for the IV estimates reported below. The third column reports a (statistically insignificant) estimate that is economically significant: Given this estimate, an increase in BE by one standard deviation (about 100 basis points) strengthens the effect of UES on TS by 17 percent relative to the baseline (mean BE) (0.00079/0.00454). This drops to a much lower (absolute) value if we switch to our instrument for BE: 4 percent (0.000189/0.0042) The estimates regarding the instrument appear in the rightmost column of Table 5.

We conclude that there is little evidence that bank capitalization correlates with the sensitivity of TS to UES. This alleviates the concern that our previous estimates regarding effects of BE (Table 4) come from a potential correlation with the extent to which snow risk induces demand risk in ski tourism. The alternative is that BE affects the sensitivity of employment to labor productivity risk (caused by demand risk).

We next present IV estimates regarding the – generalizable – effect of bank capitalization on the sensitivity of employment with respect to labor productivity risk. This evidence results from our instrument for BE. While it remains unclear whether we need this instrument, Table 5's small estimate for its interaction with UES suggests that it does not strongly pick up cross-sectional variation in effects of snow risk on labor productivity risk in ski tourism. The instrument, therefore, appears to be suitable for removing these effects from regressions measuring how snow risk affects employment. The resulting estimates should reveal effects of labor productivity risk *per se*.

IV estimates: Table 6 presents the IV estimates in the right-most column. These estimates can be compared to the first column, where we repeat the OLS estimates from the second column of Table 4. The two middle columns of Table 6 present first-stage regressions. Throughout, we use the same set of fixed effects as in Table 4 and report standard errors clustered at the municipality-year level.

The IV estimates are rather similar to the OLS estimates with respect to the baseline effects of Snow Risk SR and Expected Snow ES. We, however, see substantially different estimates regarding these variables' interactions with Bank Equity BE. In the IV estimates, the coefficient of the interaction of BE and ES is statistically insignificant and substantially smaller than in the OLS estimates. With respect to the interaction of SR and BE, the

IV estimates show a coefficient substantially higher than the OLS estimates. Given the baseline coefficient of SR in the last column of Table 6, an increase in this risk by one standard deviation (i.e., by about 0.08) causes a reduction in employment of about 1.8% (0.08 times -0.223). This effect – measured at mean BE (because our regressions use de-meaned measures of BE) – drops to roughly zero if Bank Equity increases by about 60 basis points (0.223/0.00353).

We can also measure the effect of BE in terms of a percentage change in the effect of SR on employment. In this respect, the IV estimates yield a substantially higher point estimate than the OLS estimates: a change of 0.5 percent vs. 1.6 percent per basis point of BE. Both results are reported in the bottom of Table 6 and are significantly different from zero close to the 5 percent level.

In summary, the regressions presented above reveal that bank capitalization affects the risk-taking of firms in banks' vicinity when the firms commit to employing workers on a quasi-fixed basis. The IV estimates are supposed to isolate this risk-taking with respect to labor productivity risk as a risk which is generally relevant. We, however, have no strong reason to prefer the IV estimates to the OLS estimates. There is no evidence that bank capitalization affects the extent of demand risk induced by SR in Austrian ski tourism (Table 5). The effect of SR may therefore be solely driven by variation in firms' capacity to take labor productivity risk (induced by demand risk). In this case, OLS should be a more efficient estimation approach, and the results would be no less externally valid than the IV estimates. They also are more conservative.

6 Further evidence

In this section, we discuss evidence complementing our main result that, in areas with more strongly equity-financed banks, we see smaller effects of labor productivity risk on quasi-fixed employment. We also test whether snow shocks affect the wage income of workers in ski tourism and discuss further robustness checks which appear in the Online Appendix. We start with the wage regressions.

6.1 The effect of snow shocks on wages

Table A.2, shown in the Online Appendix, presents regressions similar to those in Table 6, but for a different dependent variable: the log of average Daily Wages DW, defined in expression (3). This variable measures the wage income of workers in ski tourism during the ski season's weeks before the turn of the year. The main explanatory variable is these weeks' sum of Unexpected Snow UES, defined in expression (6).

The regression includes all firm-years for which we can observe the dependent variable. This is a subsample of slightly larger businesses, which includes 6525 firms. Given that the variation in the dependent variable is at the firm-year level, we run the regression with firm-level fixed effects and cluster standard errors at the municipality level.

The regression fails to yield a significant baseline effect of UES on DW. This shows that, at the mean level of Bank Equity (BE), workers receive a quasi-fixed wage income, rather than bearing some risk of labor productivity shocks induced by snow shocks.

We, however, also observe some evidence that bank capitalization matters. First, we find higher wages in areas with more BE. Moreover, the IV estimates yield evidence that UES affects wages in ski resorts with below-mean levels of BE (BE$<$ 0). This suggests that, in these ski resorts, we see some risk-sharing between employers and employees. This is surprising because the risk-sharing concerns a risk of verifiable and transitory shocks. It should be efficient to transfer this risk to counterparties outside the employment relationships: the housebanks of ski tourism firms. It appears that these risk transfers are subject to some "friction" associated with insufficient bank capitalization.

We also run regressions using Expected Snow and Snow Risk instead of Unexpected Snow. Estimates for those regressions are shown in Table A.3 in the Online Appendix. They yield no new results.

6.2 The effects of snow shocks on banks

We next use bank-level balance sheet data to analyze the effects of snow shocks on the regional banks in the vicinity of ski resort municipalities, again with a focus on transitory snow shocks during the starting weeks of the ski season. This analysis complements that of the aggregated tourism balance sheet data (ATD) in the bar charts of Figure 1. These bar charts show first evidence that bank capitalization affects the risk-sharing between ski tourism businesses and their housebanks. This evidence is, however, based on a subsample which is likely to feature some selection bias since it consists of customers of the Austrian Tourism Bank.

We now use data about the population of regional Austrian banks in ski resorts to analyze the effects of snow shocks on these banks. As in our main IV analysis, we focus on banks which are part of banking groups (such as the group of the Austrian savings banks) and operate through branch offices within a 20 kilometer radius around a ski-resort municipality.

The focus of our regressions is on interest income growth. We choose this dependent variable for two reasons. The first is the evidence regarding the interest expense growth of ski tourism businesses. Figure 1 shows that, in ski resorts with better-capitalized banks, we see a stronger effect of the snow conditions on the interest expenses of tourism businesses. Can we see a similar effect in the balance sheets of banks? This should be possible because, for regional banks in Austrian ski resorts, the local tourism industry is typically the main source of interest income.

The second reason for focusing on banks' interest income is that this can yield relatively clear-cut evidence that banks support their borrowers in ski resorts when they suffer cash-flow shortfalls because the resorts have insufficient snow. While there certainly are other ways banks can provide liquidity to borrowers, it is typically unclear whether these transactions occur in response to financial distress of the borrowers. Interest obligations of borrowers are, however, largely pre-determined, so that the snow conditions in some ski resort should not affect the interest income of the resort's regional banks. If they do, the banks must be willing to take some risk of snow shocks.

Table A.4 in the Online Appendix presents the regression estimates. The dependent variable is the first difference of log bank interest income. The main explanatory variable is Unexpected Snow UES during the starting weeks of the ski season – these weeks' sum of the variable defined in expression (6).

Both the OLS and the IV estimates show surprisingly strong positive baseline effects of UES on bank-level interest income. The key finding, however, is evidence that UES has a stronger effect on the interest income of banks in areas with more Bank Equity (BE). According to the IV estimates, an increase in BE by one basis point raises the effect of an unexpected additional snow week on the growth of bank-level interest income by about 1.6 percent (0.000229/0.0141). The corresponding OLS estimate is more conservative: 0.5 percent.

In conclusion, our analysis of bank interest income shows that regional banks in the Austrian ski resorts offer their borrowers insurance against weather-induced cash flow shocks. This is consistent with prior evidence in Brown et al. (2021), but we add the result that the availability of this insurance depends on bank capitalization. This result can explain our previous finding that bank capitalization affects the risk aversion that the Austrian ski tourism businesses exhibit in hiring workers prior to the start of the ski season: The firms close to well capitalized banks are less averse to quasi-fixed labor costs because they have better access to bank-provided liquidity insurance.

While we have no data about specific transactions between banks and tourism firms in Austrian ski resorts, we find consistent effects of snow shocks on the interest income of the banks and on interest expenses of the firms. It is, therefore, likely that both types of evidence result from risk-sharing between the banks and firms.

6.3 Robustness checks

In the Online Appendix, we report two robustness checks addressing a concern regarding the external validity of our main results. The concern is that the results come from firms in unusually tight labor markets. We, therefore, test for heterogeneity of the effects of bank capitalization across regions featuring lower vs. higher labor market tightness (LMT). These tests show that our results are actually driven by the regions with lower LMT (which alleviates the concern about external validity). This is consistent with a theoretical argument that high LMT may actually be associated with a weaker effect of bank capitalization on the sensitivity of employment to (exogenous) labor productivity risk: LMT may reduce firms' need for bank-provided liquidity insurance when they have to cope with negative labor productivity shocks since they may find it easier to cut wages. The reason is that, in tighter labor markets, it should be easier for workers to cope with wage cuts by tapping other sources of wage income.

The robustness checks repeat the analyses in Tables 6 and A.4 while distinguishing between the subsamples with below/above median LMT. We measure LMT using unemployment rates reported by the Austrian Employment Office at the district-level. LMT is defined as $(1 - \text{unemployment rate}_{c,T})$ in county $c(i)$ and year T. The average unemployment rate in the high LMT regions is 6.7%, but it is 12.8% in the low LMT regions, so that there is a rather substantial difference between the two types of regions.

The results are reported in Tables A.6 and A.7 in the Online Appendix.

7 Conclusion

We now summarize our contribution and subsequently discuss its more general relevance.

We present an analysis of firm-level employment based on highly granular data from small firms exposed to a quantifiable risk of labor productivity shocks. Our setting yields evidence that the risk reduces firms' willingness to commit to quasi-fixed employment, and that this effect is stronger if the nearby banks have less equity capital. This evidence comes from regressions with firm-year fixed effects controlling for changes in firms' fixed assets. We can, therefore, observe changes in employment that are not associated with investment decisions.

Our analysis complements that of Alfaro et al. (2024) who document "finance multipliers" in the effects of uncertainty on investment decisions. Moreover, it contributes to the literature on real effects of bank capitalization by documenting an effect of particular relevance in macro-finance: that on the sensitivity of employment to labor productivity risk. Our contribution can be seen as an empirical analysis of the micro-foundation of the model in Arellano et al. (2019), with bank capitalization proxying for imperfections in the risk-sharing between banks and employers.

Our results come from a setting in which we can observe a risk of labor productivity shocks which are (almost certain) transitory. These shocks have no direct effects on employment and, thus, create losses when employees cannot "earn their pay." We use balance sheet data to detect effects of the shocks and observe that bank capitalization actually affects the risk-sharing between banks and tourism businesses when the latter have to "weather cash flow shocks" (Brown et al., 2021). For low levels of bank capitalization, we also find some evidence that weather-induced labor productivity shocks affect wages, so that firms share some of the risk of the shocks with their employees.

Our paper highlights a role of banks in economic adaptation to increasing weather risk. It connects this issue to the literature following Bernanke (1983) who emphasizes that, with small- and medium-sized firms lacking ready substitutes for bank credit, banks play a central role in the functioning of the economy. Our results come from firms in size classes which account for more than 30% of employment even in high-income economies.[25] These firms are typically family-owned. By focusing on this type of firm, we focus not only on a common type of firm in many developed countries, but also on a type which tends to offer greater job security than other types (Sraer and Thesmar, 2007, Ellul et al., 2018) This implies that our results regarding quasi-fixed employment are likely to matter beyond the setting we analyze. We must leave this topic for future research, but we propose that the strength of the effect of bank capitalization on the sensitivity of employment to labor productivity risk should increase in the degree of employment quasi-fixity. If so, our estimates may under-state the size of the effect because they come from data about an industry making heavy use of temporary/fixed-term employment which is often only quasi-fixed up to a certain terminal date (Cahuc et al., 2016). This type of employment actually appears to be more common if firms face financial constraints (Caggese and Cuñat, 2008, Fernandes and Ferreira, 2017).

[25] See International Labour Organization (2019) for employment shares of firms with self-employed owners, firms with 2-9 employees and larger firms (10-49 employees and more than 50 employees). In upper-middle income economies, the first two size classes still contribute about 30% of employment, while they account for almost all employment in lower income economies.

References

Acharya, Viral V, Lea Borchert, Maximilian Jager and Sascha Steffen (2021), 'Kicking the Can Down the Road: Government Interventions in the European Banking Sector', Review of Financial Studies **34**(9), 4090–4131.

Addoum, Jawad M., David T. Ng and Ariel Ortiz-Bobea (2023), 'Temperature shocks and industry earnings news', Journal of Financial Economics **150**(1), 1–45.

Alfaro, Iván, Nicholas Bloom and Xiaoji Li (2024), 'The Finance Uncertainty Multiplier', Journal of Political Economy **132**(2), 577–615.

Arellano, Cristina, Yan Bai and Patrick J. Kehoe (2019), 'Financial frictions and fluctuations in volatility', Journal of Political Economy **127**(5), 2049–2103.

Auffhammer, Maximilian (2018), 'Quantifying economic impacts from climate change', Journal of Economic Perspectives **32**(4), 33–52.

Benmelech, Efraim, Carola Frydman and Dimitris Papanikolau (2019), 'Financial frictions and employment during the great depression', Journal of Financial Economics **133**(3), 541–563.

Benmelech, Efraim, Nittai Bergman and Amit Seru (2021), 'Financing Labor', Review of Finance .

Bentolila, Samuel, Marcel Jansen and Gabriel Jimenez (2017), 'When Credit Dries Up: Job Losses in the Great Recession', Journal of the European Economic Association **16**(3), 650–695.

Berger, Allen N and Christa HS Bouwman (2009), 'Bank liquidity creation', The Review of Financial Studies **22**(9), 3779–3837.

Berger, Allen N, Christa HS Bouwman, Thomas Kick and Klaus Schaeck (2016), 'Bank liquidity creation following regulatory interventions and capital support', Journal of Financial Intermediation **26**, 115–141.

Bernanke, Ben S. (1983), 'Nonmonetary effects of the financial crisis in the propagation of the great depression', The American Economic Review **73**(3), 257–276.

Bloom, Nicholas (2014), 'Fluctuations in uncertainty', The Journal of Economic Perspectives **28**(2), 153–175.

Bloom, Nicholas, Max Floetotto, Nir Jaimovich, Itay Saporta-Eksten and Stephen J Terry (2018), 'Really uncertain business cycles', Econometrica **86**(3), 1031–1065.

Bouwman, Christa H. S. (2019), Creation and regulation of bank liquidity, in A. N.Berger, P.Molyneux and J. O. S.Wilson, eds, 'The Oxford Handbook of Banking (3rd edn)', Oxford University Press, chapter 7.

Brinkmann, Christina (2024), Do Firms Hedge Human Capital?, ECONtribute Discussion Papers Series 343, University of Bonn and University of Cologne, Germany. https://ideas.repec.org/p/ajk/ajkdps/343.html.

Brown, James R., Matthew T. Gustafson and Ivan T. Ivanov (2021), 'Weathering cash flow shocks', Journal of Finance **76**(4), 1731–1772.

Caggese, Andrea and Vicente Cuñat (2008), 'Financing constraints and fixed-term employment contracts', The Economic Journal **118**(533), 2013–2046.

Cahuc, Pierre, Olivier Charlot and Franck Malherbet (2016), 'Explaining the spread of temporary jobs and its impact on labor turnover', International Economic Review **57**(2), 533–572.

Chodorow-Reich, Gabriel (2014), 'The employment effects of credit market disruptions: Firm-level evidence from the 2008–9 financial crisis', The Quarterly Journal of Economics **129**(1), 1–59.

Christiano, Lawrence J, Roberto Motto and Massimo Rostagno (2014), 'Risk shocks', American Economic Review **104**(1), 27–65.

Cornett, Marcia Millon, Jamie John McNutt, Philip E Strahan and Hassan Tehranian (2011), 'Liquidity risk management and credit supply in the financial crisis', Journal of financial economics **101**(2), 297–312.

Del Bono, Emilia and Andrea Weber (2008), 'Do wages compensate for anticipated working time restrictions? evidence from seasonal employment in austria', Journal of Labor Economics **26**(1), 181–221.

Dell, Melissa, Benjamin F Jones and Benjamin A Olken (2014), 'What do we learn from the weather? The new climate-economy literature', Journal of Economic Literature **52**(3), 740–98.

Dörflinger, Celine, Aliette Dörflinger, Karin Gavac and Brigitte Vogl (2013), Familienunternehmen in Österreich, KMU Forschung Austria.

Ellul, Andrew, Marco Pagano and Fabiano Schivardi (2018), 'Employment and wage insurance within firms: Worldwide evidence', The Review of Financial Studies **31**(4), 1298–1340.

Eurostat (2006), Panorama on Tourism.

Favilukis, Jack, Xiaolan Lin and Xingtan Zhao (2020), 'The elephant in the room: The impact of labor obligations on credit markets', American Economic Review **110**(6), 1673–1712.

Fernandes, Ana P. and Priscila Ferreira (2017), 'Financing constraints and fixed-term employment: Evidence from the 2008-9 financial crisis', European Economic Review **92**, 215–238.

Gali, Jordi and Thijs van Rens (2020), 'The Vanishing Procyclicality of Labour Productivity', The Economic Journal **131**(633), 302–326.

Gatev, Evan and Philip E Strahan (2006), 'Banks' advantage in hedging liquidity risk: Theory and evidence from the commercial paper market', The Journal of Finance **61**(2), 867–892.

Ghaly, Mahmoud, Viet Anh Dang and Konstantinos Stathopoulos (2017), 'Cash holdings and labor heterogeneity: The role of skilled labor', Review of Financial Studies **30**(10), 3636–3668.

Gilchrist, Simon, Jae W Sim and Egon Zakrajsek (2014), Uncertainty, financial frictions, and investment dynamics, Working Paper 20038, National Bureau of Economic Research.

Giroud, Xavier, Holger M Mueller, Alex Stomper and Arne Westerkamp (2011), 'Snow and Leverage', The Review of Financial Studies **25**(3), 680–710.

Greenstone, Michael, Alexandre Mas and Hoai-Luu Nguyen (2020), 'Do credit market shocks affect the real economy? quasi-experimental evidence from the great recession and "normal" economic times', American Economic Journal: Economic Policy **12**(1), 200–225.

Guertzgen, Nicole (2014), 'Wage insurance within German firms: Do institutions matter?', Journal of the Royal Statistical Society: Series A (Statistics in Society) **177**(2), 345–369.

Guiso, Luigi and Luigi Pistaferri (2020), 'The insurance role of the firm', The Geneva Risk and Insurance Review **45**(1), 1–23.

Guiso, Luigi, Luigi Pistaferri and Fabiano Schivardi (2005), 'Insurance within the firm', Journal of Political Economy **113**(5), 1054–1087.

Haan, Wouter den, Garey Ramey and Joel Watson (2000), 'Job destruction and propagation of shocks', American Economic Review **90**(3), 482–498.

Haushofer, Christoph (2013), Familienunternehmen in Österreich: Eine aktuelle studie der wko, Technical Report 2013/11, Wirtschaftskammer Österreich, Stabsabteilung Wirtschaftspolitik, Wien. `https://www.wko.at/service/studien-berichte/familienunternehmen-in-oesterreich.html`.

Hochfellner, Daniela, Joshua Montes, Martin Schmalz and Denis Sosyura (2015), 'Winners and Losers of Financial Crises: Evidence from Individuals and Firms', University of Michigan: Working Paper .

Holmström, Bengt and Jean Tirole (1998), 'Private and public supply of liquidity', Journal of Political Economy **106**(1), 1–40.

International Labour Organization (2019), 'World employment and social outlook: Trends 2020'. `https://www.ilo.org/sites/default/files/wcmsp5/groups/public/@dgreports/@dcomm/@publ/documents/publication/wcms_723282.pdf`.

Jordà, Òscar, Björn Richter, Moritz Schularick and Alan M Taylor (2021), 'Bank capital redux: Solvency, liquidity, and crisis', The Review of Economic Studies **88**(1), 260–286.

Kashyap, Anil K, Raghuram Rajan and Jeremy C Stein (2002), 'Banks as liquidity providers: An explanation for the coexistence of lending and deposit-taking', The Journal of Finance **57**(1), 33–73.

Knight, Frank H (1921), 'Risk, uncertainty and profit', Library of Economics and Liberty .

Koetter, Michael, Felix Noth and Oliver Rehbein (2020), 'Borrowers under water! rare disasters, regional banks, and recovery lending', Journal of Financial Intermediation **43**, 100811.

Kotlarski, Sven, Andreas Gobiet, Samuel Morin, Marc Olefs, Jan Rajczak and Raphaëlle Samacoïts (2023), '21st century alpine climate change', Climate Dynamics **60**, 65–86.

Kuzmina, Olga (2023), 'Employment flexibility and capital structure: Evidence from a natural experiment', Management Science **69**(9), 4992–5017.

Matsa, David A. (2018), 'Capital structure and a firm's workforce', Annual Review of Financial Economics **10**, pp. 387–412.

Nishesh, Naman, Paige Ouimet and Elena Simintzi (2024), Labor and corporate finance, in D. J.Denis, ed., 'Handbook of Corporate Finance', Edward Elgar Publishing, Cheltenham, UK; Northampton, MA, USA, chapter 17, pp. 647–673.

Nizalova, Olena Y. and Irina Murtazashvili (2016), 'Exogenous treatment and endogenous factors: Vanishing of omitted variable bias on the interaction term', Journal of Econometric Methods **5**(1), 71–77.

Oi, Walter Y. (1962), 'Labor as a quasi-fixed factor', Journal of Political Economy **70**(6), 538–555.

Pagano, Marco (2020), 'Risk sharing within the firm: A primer', Foundations and Trends(R) in Finance **12**(2), 117–198.

Peek, Joe and Eric S. Rosengren (2000), 'Collateral damage: Effects of the japanese banking crisis on real activity in the u.s.', American Economic Review **90**(1), 30–45.

Popov, Alexander A and Jörg Rocholl (2015), Financing constraints, employment, and labor compensation: Evidence from the subprime mortgage crisis, Technical report, WP, ECB Frankfurt.

Quadrini, Vincenzo (2017), 'Bank liabilities channel', Journal of Monetary Economics **89**, 25–44.

Rehbein, Oliver and Steven Ongena (2022), 'Flooded through the back door: The role of bank capital in local shock spillovers', Journal of Financial and Quantitative Analysis **57**(7), 2627–2658.

Schöner, Wolfgang and Johann Hiebl (2009), webklim.at. Präsentation hochauflösender Klimainformation im Internet am Beispiel von Lufttemperatur, Niederschlag und Schneedecke., Technical report, ZAMG Project Report.

Schüwer, Ulrich, Claudia Lambert and Felix Noth (2019), 'How do banks react to catastrophic events? Evidence from Hurricane Katrina', Review of Finance **23**(1), 75–116.

Serfling, Matthew (2016), 'Firing costs and capital structure decisions', Journal of Finance **71**(5), 2239–2286.

Simintzi, Elena, Vikrant Vig and Paolo Volpin (2015), 'Labor protection and leverage', Review of Financial Studies **28**(2), 561–591.

Sraer, David and David Thesmar (2007), 'Performance and behavior of family firms: Evidence from the french stock market', Journal of the European Economic Association **5**(4), 709–751.

Starr-McCluer, Martha (2000), The effects of weather on retail sales, Finance and Economics Discussion Series 2000-08, Board of Governors of the Federal Reserve System (U.S.). https://ideas.repec.org/p/fip/fedgfe/2000-08.html.

Steiger, Robert and Bruno Abegg (2013), 'The sensitivity of austrian ski areas to climate change', Tourism Planning Development **10**(4), 480–493.

Thakor, Anjan V. (2014), 'Bank capital and financial stability: An economic tradeoff or a faustian bargain?', Annual Review of Financial Economics **6**, 185–223.

Töglhofer, Christoph, Franz Eigner and Franz Prettenthaler (2011), 'Impacts of snow conditions on tourism demand in Austrian ski areas', Climate Research **46**(1), 1–14.

Töglhofer, Christine, Franz Prettenthaler and Angela Köppl (2009), Impacts of snow conditions on tourism demand in austrian ski areas, Technical report, Joanneum Research and WIFO. https://docslib.org/doc/1237078/estimating-climatic-and-economic-impacts-on-tourism-demand-in-austrian-ski-areas.

WKO (2016), Tourismus und Freizeitwirtschaft in Zahlen - Österreichische und internationale Tourismus- und Wirtschaftsdaten, Wirtschaftskammer Österreich.

Zweimüller, Josef, Rudolf Winter-Ebmer, Rafael Lalive, Andreas Kuhn, Jean-Philippe Wuellrich, Oliver Ruf and Simon Büchi (2009), The Austrian Social Security Database (ASSD), Working Paper 0901, University of Linz.

8 Figures and tables

Figure 1: Snow Shocks in Austrian ski tourism

These bar charts depict average growth rates of balance sheet variables for Austrian ski tourism businesses: operating revenue growth (top left), interest expenditure growth (top right), growth rates for short-term bank debt (bottom left) and how these growth rates deviate from operating revenue growth (bottom right). We compute averages of these variables across four groups of municipality-years (MY). First, we distinguish between municipalities where local banks have below- or above-median equity ratios (Low BE vs. High BE). Within each of these categories, we further split the sample based on the sign of unexpected snow during the starting weeks of the ski season (Negative UES vs. Positive UES). The number of firms in each group is shown on the x-axis. For formal definitions of the variables, see Section 4.2.

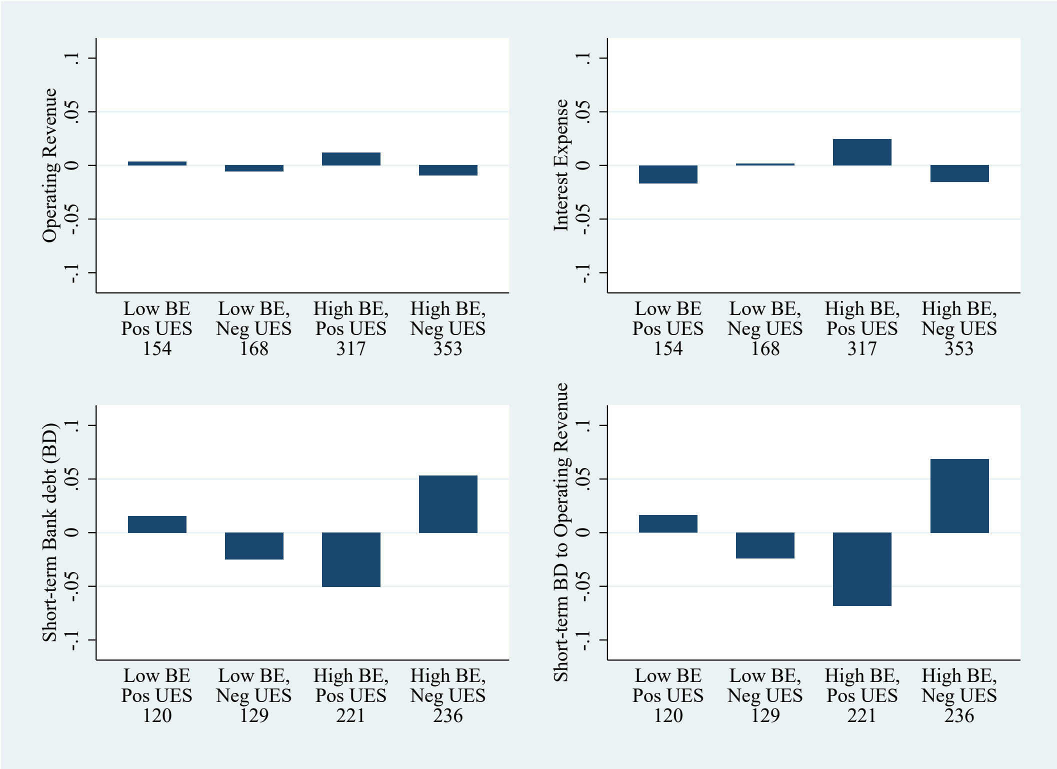
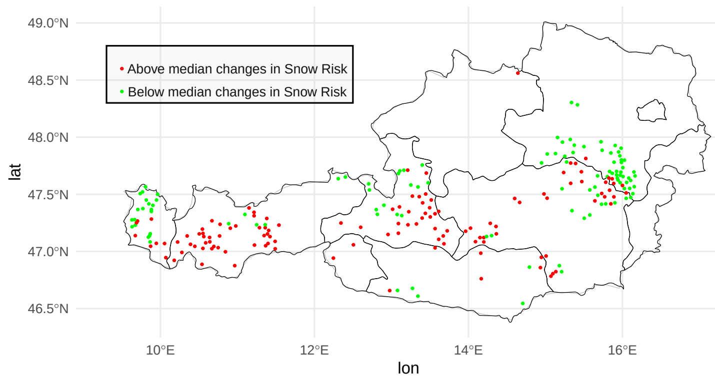
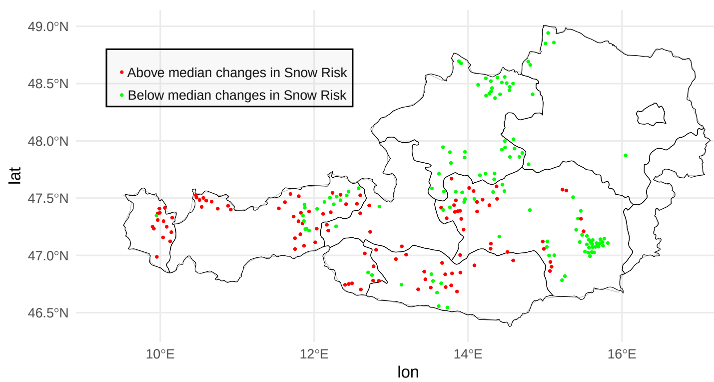


Figure 2: Trends in Snow Risk

These maps show changes in Snow Risk over the sample duration (1998-2006) for Austrian ski resorts in high and low Bank Equity (BE) regions based on the variable defined in expression (7) - BE^{all}. Changes in Snow Risk are calculated using the regression for the starting weeks of the ski season reported in column 7 of table A.1. We distinguish between ski resorts in which the local banks have a below-/above-median equity ratio (Low BE vs. High BE) and further split each group into two subgroups which differ in terms of their changes in Snow Risk over time. The color-coding is defined as below median (green)/above median (red) changes in Snow Risk over time. For formal definitions of the variables, see Section 4.2.



(a) Ski Resorts with Low Bank Equity



(b) Ski Resorts with High Bank Equity

Figure 3: Snow Risk and Employment Days

This bar chart depicts the seasonal employment of Austrian ski tourism businesses during the starting weeks of the ski season, distinguishing between municipality-weeks with different levels of Snow Risk (SR) and Bank Equity (BE). We perform median splits for two variables, SR and BE^{all} - defined in expression (5) and (7). This results in four groups for which we present group level averages of adjusted employment in bars 1 to 4. The solid (dashed) horizontal line depicts the average level of weekly Employment Days (ED) for firms located in areas with low (high) BE.

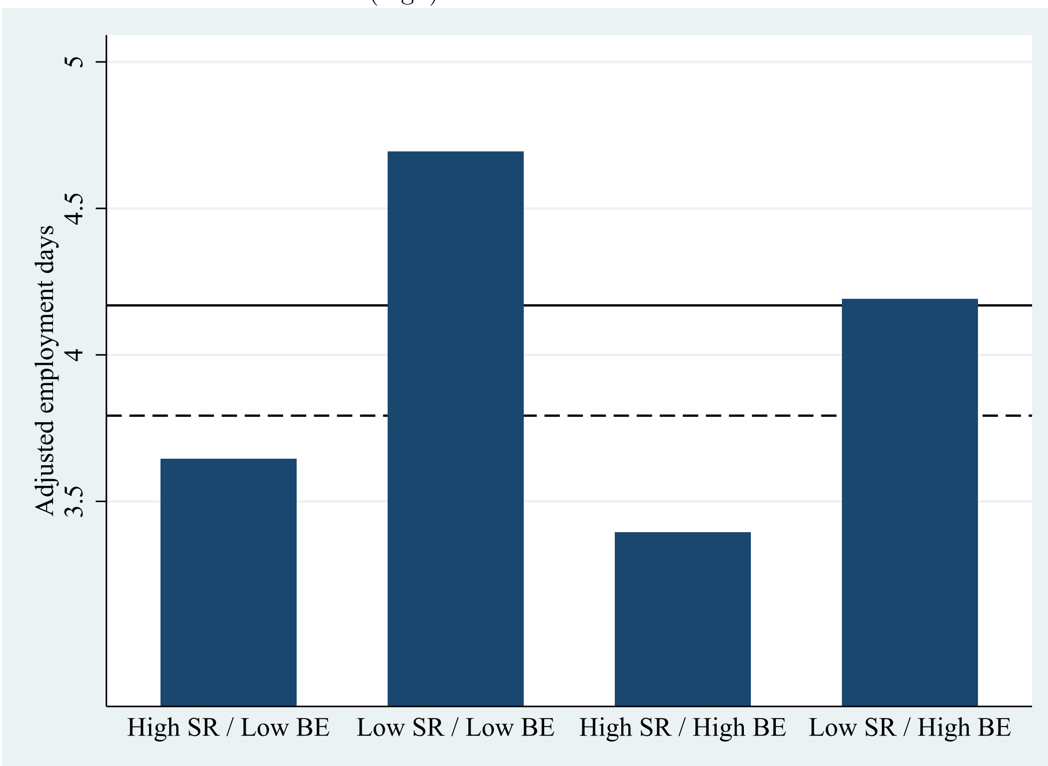


Table 1: **Summary Statistics of Balance Sheet Data**

Panel A reports statistics regarding variables describing the local banks of municipalities close to Austrian ski resorts. We split the variation in our banking measures into variation between and within municipalities. Bank Equity (BE) is defined as the average equity ratio of banks operating in a 20 kilometer radius around a municipality - the 'local' banks. We compute separate measures both for all banks (*all*) and for the subset of regional member banks of banking groups (*reg*). We report separate statistics based on bank-level balance sheet data and, for the regional member banks, based on balance sheet data aggregated at the level of Austria's banking groups (*grp*), e.g., the group of savings banks. BE is reported in basis points. In panel B, we report averages of balance sheet variables across Austrian ski tourism businesses in 70 muncipalities and 163 municipality-years (MYs) during the years 2000-2006. The observations shown are the number of firm-level observations behind the MY-level averages. We further calculate further calculate averages for these variables across municipality-years with above-median (high) and below-median (low) BE. For formal definitions of the variables, see Section 4.2.

Panel A: Austrian Banks

Variable	Mean	SD			Obs
		overall	between	within	
BE^{all}	818.013	125.846	80.278	96.989	3654
BE^{reg}	801.682	116.652	78.841	86.055	3654
BE^{grp}	802.193	81.376	12.304	80.442	3654

Panel B: Tourism Businesses

Variable	Difference	Mean			Obs
		overall	low BE	high BE	
Operating Revenue	83151	1679113	1622952	1706104	992
Wage bill	38695***	352595	326460	365155	992
Interest Expense	4213	87570	84725	88938	992
Total debt	-11510	3410384	3418166	3406656	991
Short-term debt	-42563**	523450	552197	509633	992
Short-term bank debt	-66360***	142991	186111	119751	711
Bank deposits	-22501*	103567	118275	95773	537

Table 2: **Summary Statistics of Main Variables**

This table reports summary statistics regarding employment and the snow conditions in Austrian ski resorts during different parts of the ski season, for the years 1998-2006. We split the variation into variation between and within firm-years. Employment Days is the total number of days seasonal employees are employed during a firm-week, whereas Permanent Employment Days is defined in the same manner but for **non** seasonal employees. Snow Days is the number of days in a week for which a ski resort's average snow coverage exceeds 15 centimeters. Weeks in which the majority of days are Snow Days are considered Snow Weeks. Expected Snow (Snow Risk) is the backward-looking 5 year average (variance) of Snow Week in a given resort and week, e.g. the week before Christmas. For formal definitions of the variables, see Section 4.2.

Variable	Mean	SD			Obs
		overall	between	within	
			High season		
Permanent Employment Days	12.607	41.521	41.151	5.535	975288
Employment Days	16.359	40.101	39.7	5.655	975288
Expected snow	.782	.254	.22	.128	975288
Snow risk	.132	.129	.1	.081	975288
Snow week	.82	.384	.276	.267	975288
Snow days	5.766	2.522	1.899	1.66	975288
			Starting weeks		
Permanent Employment Days	11.584	40.31	40.23	2.536	325096
Employment Days	3.976	20.542	18.146	9.628	325096
Expected snow	.383	.272	.219	.162	325096
Snow risk	.203	.114	.081	.08	325096
Snow week	.397	.489	.406	.272	325096
Snow days	2.847	3.151	2.717	1.595	325096
			Ending weeks		
Permanent Employment Days	12.604	41.052	41.013	1.793	406370
Employment Days	11.99	34.767	33.873	7.832	406370
Expected snow	.633	.326	.299	.132	406370
Snow risk	.157	.131	.11	.072	406370
Snow week	.681	.466	.386	.262	406370
Snow days	4.749	3.091	2.65	1.592	406370

Table 3: **Snow and Employment**

This table reports results for regressions explaining the log of weekly Employment Days (ED) of Austrian ski tourism businesses during the years 1998-2006. The dependent variable is defined in expression (2). The explanatory variables in Austrian ski tourism concern the ski resorts' snow conditions for different weeks of the ski season. We distinguish between variables known before the start of a season (*ex-ante*), and variables describing (*within-season*) Unexpected Snow. For formal definitions of the variables, see Section 4.2. We report separate estimates based on data about the *starting* and *ending* weeks of the ski season. In parentheses, we report standard errors clustered at the municipality-year level. *,**,*** indicate statistical significance at the 10%, 5% and 1% levels respectively.

	Log(ED)					
	Starting weeks			Ending weeks		
Ex-ante						
Exp. Snow	0.202***	0.245***	0.276***	0.284***	0.284***	0.339***
	(0.0475)	(0.0490)	(0.0528)	(0.0396)	(0.0398)	(0.0445)
Snow Risk		-0.249***	-0.259***		0.0178	0.00350
		(0.0648)	(0.0648)		(0.0580)	(0.0591)
Within-season						
Unexpected Snow_{τ}			0.0283			0.0577***
			(0.0192)			(0.0194)
Unexpected $\text{Snow}_{\tau-1}$			0.0170			0.0197
			(0.0159)			(0.0131)
Unexpected $\text{Snow}_{\tau-2}$			0.00374			0.0138
			(0.0210)			(0.0149)
N	325096	325096	325096	406370	406370	406370
R^2	0.166	0.167	0.167	0.185	0.185	0.186
Firm-Year FE	YES	YES	YES	YES	YES	YES
Week FE	YES	YES	YES	YES	YES	YES

Table 4: **Bank equity, Snow Risk and Employment: OLS estimates**

This table reports results for regressions explaining the log of weekly Employment Days (ED) of Austrian ski tourism businesses during the years 1998-2006. The dependent variable is defined in expression (2). We focus on the *starting weeks* of the ski season. The starting weeks are the four weeks 47-50 of the calendar year in which a season starts. These weeks lead up to the start of the high season, i.e., the Christmas holidays. We also conduct a placebo test where we focus on the *ending weeks* of the ski season. We use explanatory variables measuring the Expected Snow and Snow Risk in ski resorts for different weeks of the ski season. Bank Equity^{all} (Bank Equity^{reg}) measures the average equity ratio of all (regional) banks located in a 20 kilometer radius around a firm's municipality, whereas Bank Equity^{grp} measures the aggregate Bank Equity of the banking groups to which the regional banks belong. For formal definitions of the variables, see Section 4.2. All Bank Equity measures are de-meaned and defined in terms of basis points. In the first three columns, we show our main estimates and column four and five use the ending weeks as a placebo test. In the last two columns, we allow the effect of Bank Equity to vary across calendar weeks (using week 1 as baseline category). In parentheses, we report standard errors clustered at the municipality-year level. *,**,*** indicate statistical significance at the 10%, 5% and 1% levels respectively. The ratio β_1/β_0 equals the coefficient of the interaction of Snow Risk and Bank Equity divided by the baseline coefficient of Snow Risk. Below our estimate regarding this ratio, we report the p-value of a test that it equals zero.

	Log(ED)						
	Main OLS estimates			Placebo		Robustness checks	
	BE^{all}	BE^{reg}	BE^{grp}	BE^{reg}	BE^{grp}	BE^{reg}	BE^{grp}
Snow Risk	-0.261***	-0.272***	-0.226***	0.0139	-0.0215	-0.272***	-0.233***
	(0.0671)	(0.0653)	(0.0643)	(0.0563)	(0.0525)	(0.0655)	(0.0640)
Bank Equity × Snow Risk	0.00130**	0.00129**	0.00194**	-0.000105	0.000646	0.00136**	0.00209***
	(0.000543)	(0.000523)	(0.000766)	(0.000413)	(0.000580)	(0.000578)	(0.000772)
Controls							
Exp. Snow	0.220***	0.234***	0.237***	0.278***	0.257***	0.242***	0.239***
	(0.0484)	(0.0484)	(0.0474)	(0.0387)	(0.0370)	(0.0489)	(0.0478)
Bank Equity × Exp. Snow	-0.00137***	-0.00122***	-0.000498	0.000682***	0.00104***	-0.00152***	-0.000395
	(0.000330)	(0.000337)	(0.000633)	(0.000255)	(0.000399)	(0.000382)	(0.000658)
Bank Equity × Week 2						-0.000190	0.000122
						(0.000162)	(0.000125)
Bank Equity × Week 3						-0.000216**	-0.0000323
						(0.000101)	(0.0000915)
Bank Equity × Week 4						-0.000176***	-0.0000730
						(0.0000556)	(0.0000529)
N	325096	325096	325096	406370	406370	325096	325096
R^2	0.168	0.168	0.167	0.185	0.186	0.168	0.167
Firm-Season FE	YES	YES	YES	YES	YES	YES	YES
Week FE	YES	YES	YES	YES	YES	YES	YES
β_1/β_0	-0.005	-0.005	-0.009	-0.0001	-0.03	-0.005	-0.009
P-Value	0.07	0.06	0.05	0.86	0.69	0.07	0.04

Table 5: **Snow shocks in Austrian ski tourism: Tourists overnight stays**

This table reports results for regressions explaining the growth of tourists' overnight stays (TS) in Austrian ski resorts during the ski-seasons 1998-2006. We use explanatory variables measuring the sum of Unexpected Snow weeks in the starting weeks of the ski season (Unexpected Snow^{start}), Bank Equity (BE), and an interaction term. Bank Equity^{reg} measures the average equity ratio of all regional banks located in a 20 kilometer radius around a municipality, whereas Bank Equity^{grp} measures the aggregate Bank Equity of the banking groups to which the regional banks belong. For formal definitions of the variables, see Section 4.2. All Bank Equity measures are de-meaned and defined in terms of basis points. The first and second column report estimates for Unexpected Snow with municipality fixed effects and without (with) year fixed effects. The third and fourth column reports results for Bank Equity^{reg} and Bank Equity^{grp} and the interaction term without year fixed effects. In parentheses, we report standard errors clustered at the municipal level. *,**,*** indicate statistical significance at the 10%, 5% and 1% levels respectively.

	Δlog(TS)			
	Unexpected Snow^{start}		Main OLS estimates	
			BE^{reg}	BE^{grp}
Unexpected Snow^{start}	0.00429**	0.00304	0.00454***	0.00420
	(0.00165)	(0.00196)	(0.00157)	(0.00355)
Bank Equity			-0.0000279	-0.0000440
			(0.0000580)	(0.0000619)
Bank Equity × Unexpected Snow^{start}			0.00000790	-0.00000189
			(0.0000160)	(0.0000372)
N	1963	1963	1963	1963
R^2	0.002	0.008	0.002	0.003
Municipality FE	YES	YES	YES	YES
Year FE	NO	YES	NO	NO

Table 6: **Bank Equity, Risk and Employment: IV estimates**

This table reports results for regressions explaining the log of weekly Employment Days (ED) of Austrian ski tourism businesses during the years 1998-2006. The dependent variable is defined in expression (2). We focus on the *starting weeks* of the ski season. The starting weeks are the four weeks 47-50 of the calendar year in which a season starts. These weeks lead up to the start of the high season, i.e., the Christmas holidays. We use explanatory variables measuring the Expected Snow and Snow Risk in ski resorts for different weeks of the ski season. Bank Equity^{reg} measures the average equity ratio of all regional banks located in a 20 kilometer radius around a municipality. The instrument for this measure is similarly defined, but measures the aggregate Bank Equity of the banking groups to which the regional banks belong (Bank Equity^{grp}). For formal definitions of the variables, see Section 4.2. All Bank Equity measures are de-meaned and defined in terms of basis points. The first column reports OLS estimates, columns 2 and 3 report the first stage estimates, and, column 4 reports the IV estimates. In parentheses, we report standard errors clustered at the municipality-year level. *,**,*** indicate statistical significance at the 10%, 5% and 1% levels respectively. The ratio β_1/β_0 equals the coefficient of the interaction of Snow Risk and Bank Equity divided by the baseline coefficient of Snow Risk. Below our estimate regarding this ratio, we report the p-value of a test that it equals zero.

	OLS	1st stage results		IV 2nd stage
	Log(ED)	Bank Equity^{reg} × Exp. Snow	Bank Equity^{reg} × Snow Risk	Log(ED)
Exp. Snow	0.234***	-2.700	-7.158***	0.260***
	(0.0484)	(4.307)	(1.773)	(0.0481)
Snow Risk	-0.272***	-36.78***	-8.220**	-0.223***
	(0.0653)	(5.743)	(3.923)	(0.0744)
Bank Equity^{reg} × Exp. Snow	-0.00122***			-0.000697
	(0.000337)			(0.00103)
Bank Equity^{reg} × Snow Risk	0.00129**			0.00353***
	(0.000523)			(0.00136)
Bank Equity^{grp} × Exp. Snow		0.599***	-0.0227	
		(0.0571)	(0.0311)	
Bank Equity^{grp} × Snow Risk		-0.0660	0.538***	
		(0.0921)	(0.0636)	
N	325096	325096	325096	325096
Firm-Year FE	YES	YES	YES	YES
Week FE	YES	YES	YES	YES
β_1/β_0	-0.005			-0.016
P-Value	0.06			0.06
F-Test of excluded instruments		110.73	77.56	
Angrist-Pischke F-Test		120.69	77.10	

Appendix

Supplementary Figures and Tables

Figure A.1: General Terms of Trade for the Austrian Hotel Industry

This figure depicts paragraph 5 of the general terms of trade of the Austrian hotel industry in the last year of our sample period (2006). Paragraph 5 defines the cancellation policy used in standard accommodation agreements.

…

§ 5 Cancellation of the Accommodation Agreement – Cancellation fee

Cancellation by the Proprietor

5.1 If the Accommodation Agreement provides for a down payment and such down payment has not been made by the Party in time, the Proprietor may rescind the Accommodation Agreement without granting any grace period.

5.2 If the Guest fails to arrive by 6.00 p.m. on the agreed date of arrival, the Proprietor shall not be obliged to accommodate them unless a later time of arrival has been agreed upon.

5.3 If the Party has made a down payment (see 3.3), the rooms shall be deemed reserved until 12.00 noon on the day following the date of arrival at the latest. If a down payment to the amount of more than four days has been made, the obligation to accommodate the Guest shall end on 6.00 p.m. on the fourth day, the date of arrival being deemed the first day, unless the Guest informs the Proprietor of a later date of arrival.

5.4 Unless otherwise agreed upon, the Proprietor may rescind the Accommodation Agreement for objectively justified reasons by means of a unilateral declaration by 3 months before the agreed date of arrival of the Party.

Cancellation by the Party – Cancellation fee

5.5 The Party may rescind the Accommodation Agreement by means of a unilateral declaration by 3 months before the agreed date of arrival of the Guest without being liable to pay a cancellation fee.

5.6 Outside the period specified in § 5.5., the Party may only rescind the Accommodation Agreement by means of a unilateral declaration subject to the following cancellation fees:

- 40% of the total agreed price by 1 month before the date of arrival;

- 70% of the total agreed price by 1 week before the date of arrival;

- 90% of the total agreed price within the last week preceding the date of arrival.

2

(a) Cancellation policy

3 months or more	3 months to 1 month	1 month to 1 week	up to 1 week
no cancellation fee	40%	70%	90%

…

3

(b) Cancellation fee schedule

Figure A.2: Snow Shocks in Austrian Ski Tourism cont.

These bar charts depict average growth rates of balance sheet variables for Austrian ski tourism businesses: wage bill growth (top left), wage bill divided by operating revenue (OR) growth (top right), growth rates for bank deposits (bottom left) and again how these growth rates deviate from operating revenue growth (bottom right). We compute averages of these variables across four groups of municipality-years (MY). First, we distinguish between municipalities where local banks have below- or above-median equity ratios (Low BE vs. High BE). Within each of these categories, we further split the sample based on the sign of unexpected snow during the starting weeks of the ski season (Negative UES vs. Positive UES). The number of firms in each group is shown on the x-axis. For formal definitions of the variables, see Section 4.2.

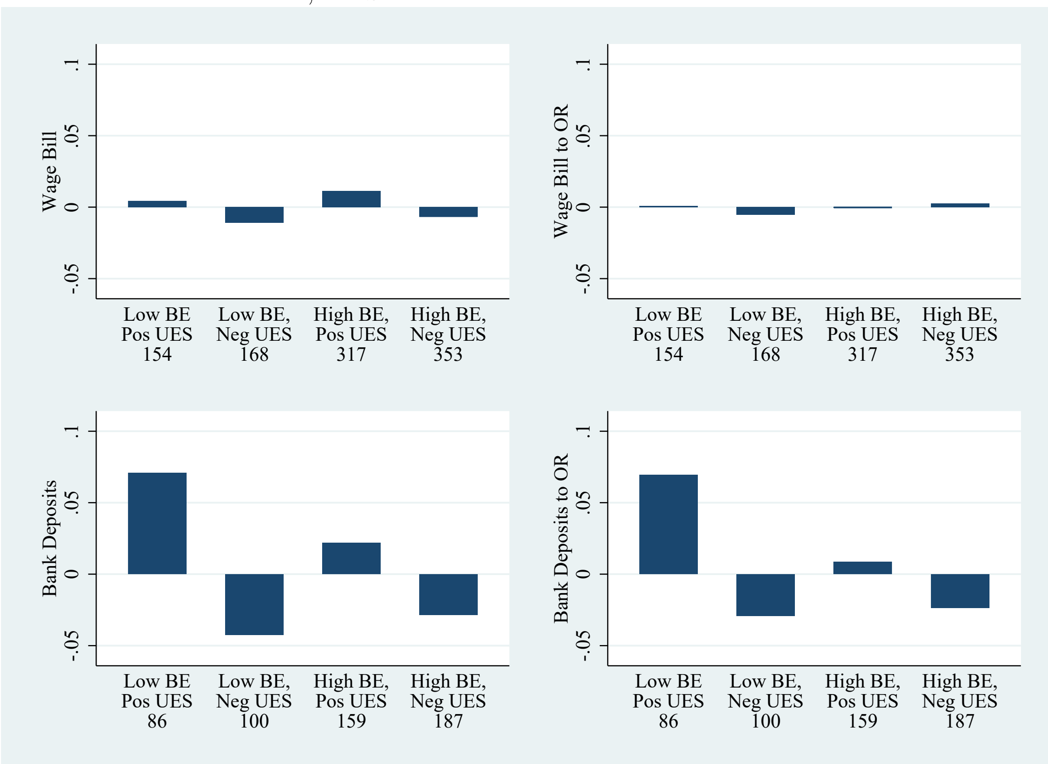


Figure A.3: Matching Snow Data and Municipalities

This figure illustrates the matching of snow data to municipalities in Austrian ski resorts. The grid of points shows the locations for which we have snow data. For each ski lift, we use the data for the grid point closest to the center of the line representing the ski lift. We first collect the coordinates of all ski lifts within a radius of 10 km for each municipality's center. Next, we determine the closest data grid point to the center of each ski lift. In this figure, we demonstrate our mapping of ski lifts to municipalities for the municipality of Lech am Arlberg, a well known resort in the Austrian state of Vorarlberg. The dashed circle is at a radius of 10 kilometers around the center of Lech. To measure the snow conditions around Lech, we consider all ski lifts marked by red lines. Coordinates of ski lifts were retrieved from OpenStreetMap, the 1×1 km grid data on snow depth was provided by the Austrian Meteorological Office.

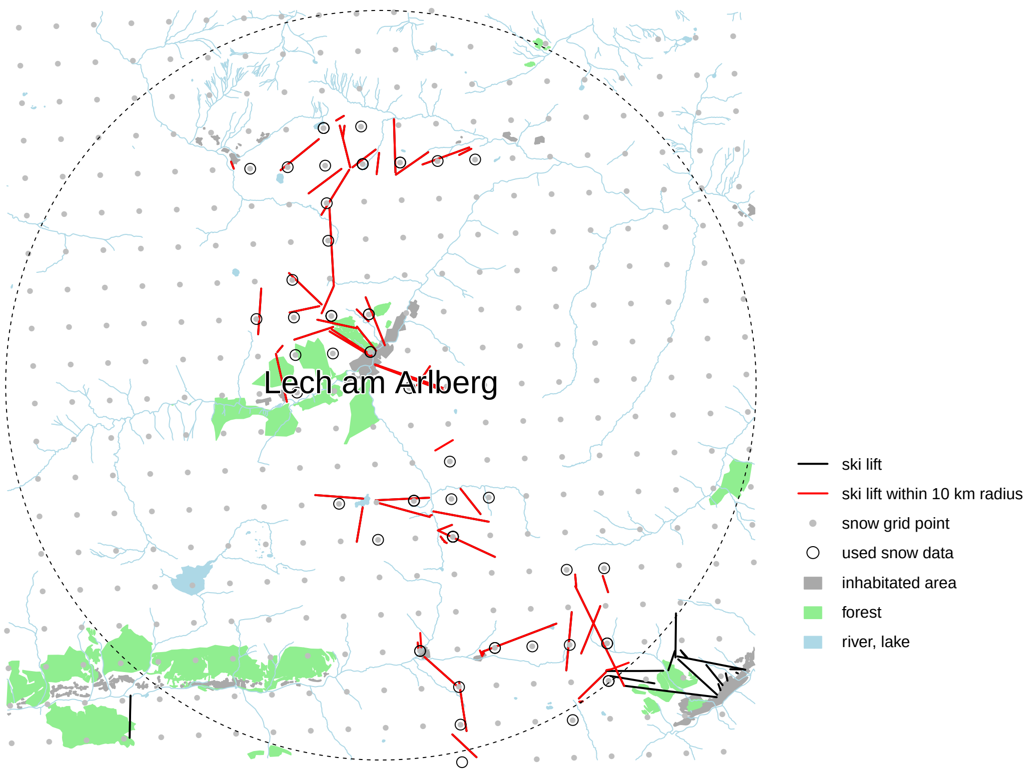


Figure A.4: Year-on-Year Changes in Aggregate Bank Equity Capitalization

This figure plots means of year-on-year changes in our instrument for Bank Equity (BE^{grp}) - defined in expression (9) - in basis points across the years 1998 (-the first year in our bank balance sheet data) and 2006 (- the last year of our snow data). The dashed line marks the overall mean (across the years). The shaded area shows a one-standard-deviation interval of the yearly means around the overall mean.

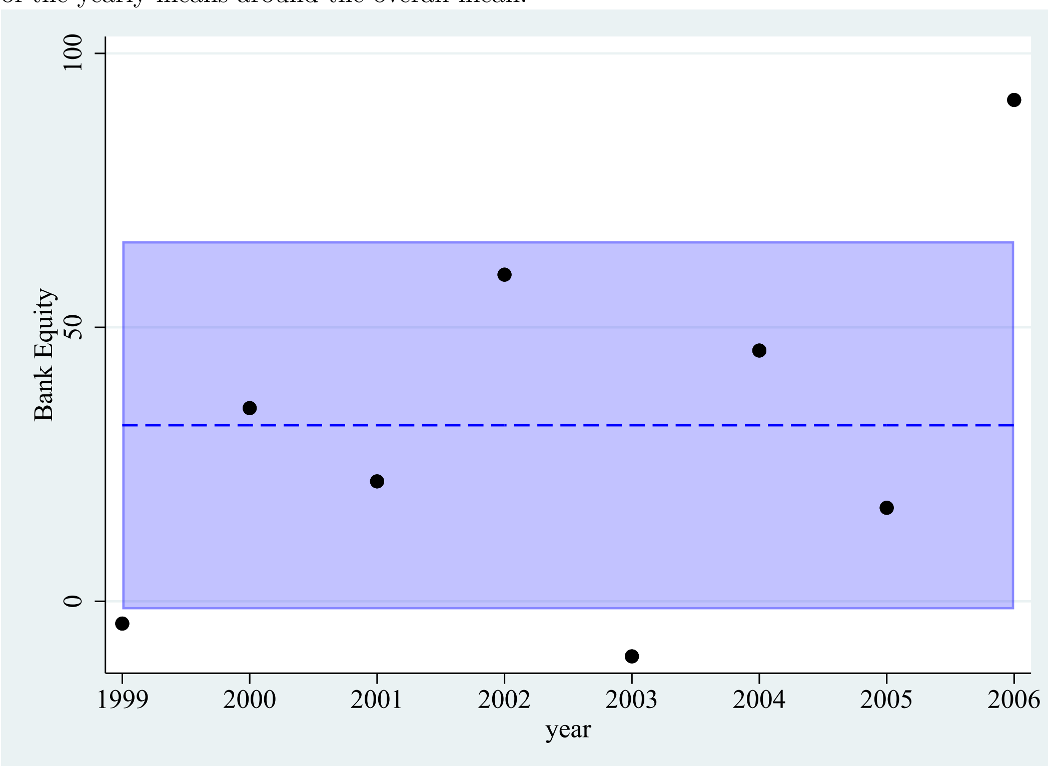


Table A.1: **Long run Trends in Snow Conditions in Austrian Ski Resorts**

This table reports regressions measuring long-run trends in our measures of Expected Snow and Snow Risk in Austrian ski resorts during the years 1983-2007. The dependent variables are defined in expressions (4) and (5). While our snow data starts in 1978, we need the first five years of data to compute the value of the dependent variables of our regressions for the year 1983. We measure linear time trends and allow for the trends to differ across a number of dimensions. *Altitude* is a ski resort's altitude, and *High* is a dummy variable indicating ski resorts at above-median altitude. *Start* (*End*) are dummy variables indicating the starting (ending) weeks of the year. In parentheses, we report clustered standard errors. We cluster the standard errors at the level of ski resorts to address the problem that consecutive years' observations of our dependent variables are based on overlapping snow data. *,**,*** indicate statistical significance at the 10%, 5% and 1% levels respectively.

	Expected Snow				**Snow Risk**			
$Year$	-0.00538***	-0.00591***	-0.00543***	-0.00605***	0.00142***	0.00110***	0.00208***	0.00204***
	(0.000172)	(0.000236)	(0.000184)	(0.000259)	(0.0000921)	(0.000130)	(0.000113)	(0.000160)
$Year \times Altitude$	0.000938***		0.000962***		0.000166*		-0.000159	
	(0.000161)		(0.000173)		(0.0000899)		(0.000103)	
$Year \times High$		0.00147***		0.00166***		0.000705***		0.0000243
		(0.000335)		(0.000355)		(0.000176)		(0.000214)
$Year \times Start$			0.00640***	0.00599***			-0.00210***	-0.00253***
			(0.000241)	(0.000332)			(0.000144)	(0.000200)
$Year \times End$			-0.00491***	-0.00420***			-0.00111***	-0.00189***
			(0.000239)	(0.000308)			(0.000149)	(0.000205)
$Year \times Altitude \times Start$			0.000323				0.000454***	
			(0.000247)				(0.000140)	
$Year \times Altitude \times End$			-0.000361				0.00100***	
			(0.000245)				(0.000123)	
$Year \times High \times Start$				0.000960**				0.00106***
				(0.000474)				(0.000277)
$Year \times High \times End$				-0.00157***				0.00201***
				(0.000482)				(0.000285)
N	473550	473550	473550	473550	473550	473550	473550	473550
R^2	0.051	0.051	0.077	0.077	0.012	0.013	0.017	0.017
Resort-Week FE	YES	YES	YES	YES	YES	YES	YES	YES

Table A.2: **Bank Equity, Snow Shocks and Wages: IV estimates**

This table reports results for instrumental variables (IV) regressions explaining the average wage for tourism businesses in Austrian ski resort municipalities during the years 1998-2006. We focus on the *starting weeks* of the ski season. The starting weeks are the four weeks 47-50 of the calendar year in which a season starts. These weeks lead up to the start of the high season, i.e., the Christmas holidays. We use explanatory variables measuring Unexpected Snow observed in the starting weeks of ski season, Bank Equity, and an interaction term. Bank Equity^{reg} measures the average equity ratio of all regional banks located in a 20 kilometer radius around a municipality. The instrument for this measure is similarly defined, but measures the aggregate Bank Equity of the banking groups to which the regional banks belong (Bank Equity^{grp}). For formal definitions of the variables, see Section 4.2. All Bank Equity measures are de-meaned and defined in terms of basis points. The first column reports OLS estimates, columns 2 and 3 report the first stage estimates, and, column 4 reports the IV estimates. In parentheses, we report standard errors clustered at the municipal level. *,**,*** indicate statistical significance at the 10%, 5% and 1% levels respectively.

	OLS	1st stage results		IV 2nd stage
	Avg. Wage	Bank Equity^{reg} × 1	Bank Equity^{reg} × Unexpected Snow^{start}	Avg. Wage
Unexpected Snow^{start}	-0.00292	-1.614	7.395	0.00127
	(0.00222)	(1.467)	(19.60)	(0.00552)
Bank Equity^{reg}	0.000735***			0.00163***
	(0.0000558)			(0.000258)
Bank Equity^{reg} × Unexpected Snow^{start}	-0.00000823			-0.000296***
	(0.0000182)			(0.0000812)
Bank Equity^{grp}		0.422***	0.160	
		(0.0664)	(0.111)	
Bank Equity^{grp} × Unexpected Snow^{start}		0.0587***	0.454***	
		(0.0215)	(0.120)	
N	20336	17881	17881	17881
Firm FE	YES	YES	YES	YES
F-Test of excluded instruments		29.83	9.54	
Angrist-Pischke F-Test		34.31	15.78	

Table A.3: **Bank Equity, Snow Risk and Wages: IV estimates**

This table reports results for instrumental variables (IV) regressions explaining the average wage for tourism businesses in Austrian ski resort resort municipalities during the years 1998-2006. We focus on the *starting weeks* of the ski season. The starting weeks are the four weeks 47-50 of the calendar year in which a season starts. These weeks lead up to the start of the high season, i.e., the Christmas holidays. We use explanatory variables measuring the sum of Expected Snow and Snow Risk weeks in the starting weeks of the ski season. Bank Equity^{reg} measures the average equity ratio of all regional banks located in a 20 kilometer radius around a municipality. The instrument for this measure is similarly defined, but measures the aggregate Bank Equity of the banking groups to which the regional banks belong (Bank Equity^{grp}). For formal definitions of the variables, see Section 4.2. All Bank Equity measures are de-meaned and defined in terms of basis points. The first column reports OLS estimates, columns 2, 3 and 4 report the first stage estimates, and, column 5 reports the IV estimates. In parentheses, we report standard errors clustered at the municipal level. *,**,*** indicate statistical significance at the 10%, 5% and 1% levels respectively.

	OLS	1st stage results			IV 2nd stage
	Avg. Wage	Bank Equity^{reg}			Avg. Wage
		× 1	× Exp. Snow^{start}	× Snow Risk^{start}	
Exp. Snow^{start}	0.00657	12.96***	34.39**	27.80**	-0.0216
	(0.0113)	(4.336)	(16.67)	(13.46)	(0.0373)
Snow Risk^{start}	0.00725	1.859	0.487	14.12	0.00780
	(0.00625)	(2.653)	(6.708)	(20.32)	(0.0127)
Bank Equity^{reg}	0.000606***				0.00107*
	(0.0000892)				(0.000595)
Bank Equity^{reg} × Exp. Snow^{start}	-0.00000948				0.000934
	(0.0000866)				(0.00196)
Bank Equity^{reg} × Snow Risk^{start}	0.0000522				-0.000393
	(0.0000523)				(0.000985)
Bank Equity^{grp}		0.403***	0.0506	0.0232	
		(0.125)	(0.126)	(0.236)	
Bank Equity^{grp} × Exp. Snow^{start}		-0.0809	0.0943	0.0326	
		(0.0568)	(0.175)	(0.102)	
Bank Equity^{grp} × Snow Risk^{start}		0.0705**	0.185*	0.457***	
		(0.0332)	(0.101)	(0.0905)	
N	20470	17939	17939	17939	17939
Firm FE	YES	YES	YES	YES	YES
F-Test of excluded instruments		25.33	25.87	18.81	
Angrist-Pischke F-Test		9.51	0.25	4.53	

Table A.4: **Bank Equity, Snow Shocks and Bank Interest Income Growth: IV estimates**

This table reports results for regressions explaining the interest income (I) of banks in the vicinity of municipalities in Austrian ski resorts during the years 1998-2006. The dependent variable is the annual growth rate ($\Delta log(I)$) of interest income of the average regional bank operating in the 20 kilometer radius around a municipality. We use explanatory variables measuring Unexpected Snow observed in the starting weeks of ski season, Bank Equity, and an interaction term. Bank Equity^{reg} measures the average equity ratio of all regional banks located in a 20 kilometer radius around a municipality. The instrument for this measure is similarly defined, but measures the aggregate Bank Equity of the banking groups to which the regional banks belong (Bank Equity^{grp}). For formal definitions of the variables, see Section 4.2. All Bank Equity measures are de-meaned and defined in terms of basis points. The first column reports OLS estimates, columns 2 and 3 report the first stage estimates, and, column 4 reports the IV estimates. In parentheses, we report standard errors clustered at the municipal level. *,**,*** indicate statistical significance at the 10%, 5% and 1% levels respectively.

	OLS	1st stage results		IV 2nd stage
	Δlog(I)	Bank Equity^{reg} × 1	Bank Equity^{reg} × Unexpected Snow^{start}	Δlog(I)
Unexpected Snow^{start}	0.0107***	6.845*	31.74	0.0141***
	(0.00263)	(3.595)	(24.21)	(0.00511)
Bank Equity^{reg}	0.000128***			0.0000936
	(0.0000373)			(0.0000964)
Bank Equity^{reg} × Unexpected Snow^{start}	0.0000552**			0.000229***
	(0.0000230)			(0.0000679)
Bank Equity^{grp}		0.692***	0.179**	
		(0.0653)	(0.0904)	
Bank Equity^{grp} × Unexpected Snow^{start}		0.0533**	0.667***	
		(0.0234)	(0.120)	
N	3248	3248	3248	3248
Municipality FE	YES	YES	YES	YES
F-Test of excluded instruments		56.74	22.71	
Angrist-Pischke F-Test		201.58	273.98	

Table A.5: **Bank equity, Snow Risk and Employment: Different time windows**

This table reports results for a robustness check explaining the log of weekly Employment Days (ED) of Austrian ski tourism businesses during the years 1998-2006. The dependent variable is defined in expression (2). We focus on the *starting weeks* of the ski season. The starting weeks are the four weeks 47-50 of the calendar year in which a season starts. These weeks lead up to the start of the high season, i.e., the Christmas holidays. We use explanatory variables measuring the Expected Snow and Snow Risk in ski resorts for different weeks of the ski season. Expected Snow (Snow Risk) is the backward-looking 4/6 year average (variance) of Snow Week in a given resort and week. Bank Equity^{all} (Bank Equity^{reg}) measures the average equity ratio of all (regional) banks located in a 20 kilometer radius around a firm's municipality, whereas Bank Equity^{grp} measures the aggregate Bank Equity of the banking groups to which the regional banks belong. For formal definitions of the variables, see Section 4.2. All Bank Equity measures are de-meaned and defined in terms of basis points. In the first three columns, we show estimates using a 4 year window to define Expected Snow and Snow Risk. Columns four to six, by comparison, use a 6-year window. In parentheses, we report standard errors clustered at the municipality-year level. *,**,*** indicate statistical significance at the 10%, 5% and 1% levels respectively. The ratio β_1/β_0 equals the coefficient of the interaction of Snow Risk and Bank Equity divided by the baseline coefficient of Snow Risk. Below our estimate regarding this ratio, we report the p-value of a test that it equals zero.

	Log(ED)					
	4 Year Window			6 Year Window		
	BE^{all}	BE^{reg}	BE^{grp}	BE^{all}	BE^{reg}	BE^{grp}
Snow Risk	-0.167***	-0.180***	-0.133***	-0.421***	-0.428***	-0.396***
	(0.0524)	(0.0514)	(0.0494)	(0.0764)	(0.0754)	(0.0738)
Bank Equity × Snow Risk	0.00128***	0.00121***	0.00185***	0.00151***	0.00146**	0.00260***
	(0.000383)	(0.000375)	(0.000606)	(0.000579)	(0.000601)	(0.000835)
Controls						
Exp. Snow	0.133***	0.149***	0.147***	0.325***	0.337***	0.345***
	(0.0449)	(0.0448)	(0.0440)	(0.0519)	(0.0523)	(0.0522)
Bank Equity × Exp. Snow	-0.00137***	-0.00125***	-0.000643	-0.00134***	-0.00116***	-0.000138
	(0.000303)	(0.000295)	(0.000578)	(0.000336)	(0.000361)	(0.000638)
N	325096	325096	325096	325096	325096	325096
R^2	0.167	0.167	0.166	0.170	0.170	0.170
Firm-Season FE	YES	YES	YES	YES	YES	YES
Week FE	YES	YES	YES	YES	YES	YES
β_1/β_0	-0.008	-0.007	-0.014	-0.004	-0.003	-0.007
P-Value	0.04	0.03	0.05	0.03	0.04	0.01

Table A.6: **Snow, Employment, and Bank Equity: Sample splits by labor market tightness**

This table reports results for regressions explaining the log of weekly Employment Days (ED) of Austrian ski tourism businesses during the years 1998-2006. The dependent variable is defined in expression (2). We focus on the *starting weeks* of the ski season. The starting weeks are the four weeks 47-50 of the calendar year in which a season starts. These weeks lead up to the start of the high season, i.e., the Christmas holidays. We use explanatory variables measuring the Expected Snow and Snow Risk in ski resorts for different weeks of the ski season. Bank Equity^{reg} measures the average equity ratio of all regional banks located in a 20 kilometer radius around a municipality. The instrument for this measure is similarly defined, but measures the aggregate Bank Equity of the banking groups to which the regional banks belong (Bank Equity^{grp}). For formal definitions of the variables, see Section 4.2. All Bank Equity measures are de-meaned and defined in terms of basis points. We split the sample of firms based on the degree of labor market tightness (LMT) observed in the ski resort, and report the estimates separately for counties that face low and high levels of LMT. LMT is defined as $(1 - \text{unemployment rate}_{c(i),t})$ in county $c(i)$ and year t. The results are reported in two panels. The left (right) panel reports results for firms in counties with low (high) LMT. In each panel, the first column reports OLS estimates, columns 2 and 3 report the first stage estimates, and, column 4 reports the IV estimates. In parentheses, we report standard errors clustered at the municipality-year level. *,**,*** indicate statistical significance at the 10%, 5% and 1% levels respectively. The ratio β_1/β_0 equals the coefficient of the interaction of Snow Risk and Bank Equity divided by the baseline coefficient of Snow Risk. Below our estimate regarding this ratio, we report the p-value of a test that it equals zero.

	Low LMT				High LMT			
	OLS	1^{st} stage results		IV 2^{nd} stage	OLS	1^{st} stage results		IV 2^{nd} stage
	Log(ED)	Bank Equity^{reg} × Exp. Snow	Bank Equity^{reg} × Snow Risk	Log(ED)	Log(ED)	Bank Equity^{reg} × Exp. Snow	Bank Equity^{reg} × Snow Risk	Log(ED)
Exp. Snow	0.198***	11.94**	-5.559**	0.210***	0.241***	-12.81*	-7.927***	0.338***
	(0.0757)	(5.547)	(2.591)	(0.0763)	(0.0547)	(6.666)	(1.786)	(0.0794)
Snow Risk	-0.298***	-30.74***	9.653*	-0.316***	-0.140	-49.55***	-27.16***	0.0816
	(0.0877)	(7.624)	(5.336)	(0.109)	(0.0947)	(8.072)	(4.980)	(0.147)
Bank Equity^{reg} × Exp. Snow	-0.00186***			-0.00195*	0.000508			0.00463**
	(0.000491)			(0.00117)	(0.000356)			(0.00207)
Bank Equity^{reg} × Snow Risk	0.00199***			0.00355**	-0.000239			0.000651
	(0.000700)			(0.00161)	(0.000712)			(0.00262)
Bank Equity^{grp} × Exp. Snow		0.679***	-0.0103			0.442***	-0.0206	
		(0.0696)	(0.0434)			(0.0806)	(0.0239)	
Bank Equity^{grp} × Snow Risk		0.0358	0.616***			-0.0756	0.435***	
		(0.124)	(0.0950)			(0.108)	(0.0615)	
N	154456	154456	154456	154456	166824	166824	166824	166824
Firm-Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Week FE	YES	YES	YES	YES	YES	YES	YES	YES
β_1/β_0	-0.007			-0.011	0.002			0.008
P-Value	0.03			0.01	0.71			0.76
F-Test of excluded instruments		80.44	45.08			26.75	28.52	
Angrist-Pischke F-Test		98.90	40.73			32.46	52.30	

Table A.7: **Banks' provision of liquidity insurance: Sample splits by labor market tightness**

This table reports results for regressions explaining the interest income (I) of banks in the vicinity of municipalities in Austrian ski resorts during the years 1998-2006. The dependent variable is the annual growth rate ($\Delta log(I)$) of interest income of the average regional bank operating in the 20 kilometer radius around a municipality. We use explanatory variables measuring Unexpected Snow observed in the starting weeks of ski season, Bank Equity, and an interaction term. Bank Equity^{reg} measures the average equity ratio of all regional banks located in a 20 kilometer radius around a municipality. The instrument for this measure is similarly defined, but measures the aggregate Bank Equity of the banking groups to which the regional banks belong (Bank Equity^{grp}). For formal definitions of the variables, see Section 4.2. All Bank Equity measures are de-meaned and defined in terms of basis points. We split the sample of firms based on the degree of labor market tightness (LMT) observed in the ski resort, and report the estimates separately for counties that face low and high levels of LMT. LMT is defined as $(1 - \text{unemployment rate}_{c(i),t})$ in county $c(i)$ and year t. The results are reported in two panels. The left (right) panel reports results for firms in counties with low (high) LMT. In each panel, the first column reports OLS estimates, columns 2 and 3 report the first stage estimates, and, column 4 reports the IV estimates. In parentheses, we report standard errors clustered at the municipal level. *,**,*** indicate statistical significance at the 10%, 5% and 1% levels respectively.

	Low LMT				High LMT			
	OLS	1^{st} stage results		IV 2^{nd} stage	OLS	1^{st} stage results		IV 2^{nd} stage
	$\Delta Log(I)$	Bank Equity^{reg} ×1	Bank Equity^{reg} × UE Snow	$\Delta Log(I)$	$\Delta Log(I)$	Bank Equity^{reg} × 1	Bank Equity^{reg} × UE Snow	$\Delta Log(I)$
Unexpected Snow^{start}	0.00214	3.085	2.995	-0.00311	0.0127***	-0.772	9.804	0.0122**
	(0.00434)	(3.317)	(29.84)	(0.0113)	(0.00297)	(2.189)	(19.91)	(0.00479)
Bank Equity^{reg}	0.0000770			-0.0000136	0.000142*			0.000220
	(0.0000462)			(0.000138)	(0.0000718)			(0.000154)
Bank Equity^{reg} × Unexpected Snow^{start}	0.0000655***			0.000275***	0.0000432			0.000159
	(0.0000198)			(0.0000802)	(0.0000424)			(0.000100)
Bank Equity^{grp}		0.666***	0.269			0.652***	0.0919	
		(0.0905)	(0.197)			(0.104)	(0.0775)	
Bank Equity^{grp} × Unexpected Snow^{start}		0.0548	0.816***			0.0138	0.602***	
		(0.0378)	(0.188)			(0.0268)	(0.122)	
N	1388	1365	1365	1365	1480	1461	1461	1461
Municipality FE	YES	YES	YES	YES	YES	YES	YES	YES
F-Test of excluded instruments		28.00	11.59			20.60	12.17	
Angrist-Pischke F-Test		55.86	20.05			38.60	24.23	