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Volume 2 | Issue 1 | January 2020 | Page 1 - 39
Journal of Psychological Research

# Contents

## ARTICLE



## REVIEW

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ARTICLE

# Autism Spectrum Disorder: The Dilemma of Untimely Recognition, Intervention and Diagnostic Scales Obtainable at Indian Sub-continent

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ABSTRACT

The increasing prevalence of Autism Spectrum Disorder makes it as considerable issue worldwide. Recent studies addresses the hot topic of Mirror Neuronal System (MNS) confers behind the ASD. However, the cause is uncertain, Indian population prone to varied prenatal and postnatal factors of the condition. Indian parents and professional still be at the initial awareness phase of the spectrum. Years of delay in identification and intervention while comparing with world standards due to various Indian socio-economic and socio-cultural factors. Less availability of screening and diagnostic tools headed to relay on culturally irrelevant and expensive international tools. Government funded research initiatives developed ISAA, INDT-ASD, CASI and AIIMS Modified INDT-ASD as culturally relevant indigenous tools and available on practice. So far, the tools have their own advantages and limitations, requires further research and progression. Owing to scarcity of trained professionals for a wide population range, home based parent-mediated therapies be the most preferred mode of therapy. However, the therapeutic options vary with people. The study aimed to ascertain the present Indian scenario, look upon the awareness about the condition, availability of screening and diagnostic facilities, the early identification and timely intervention program. In addition, the study briefly confers the biological and clinical background of ASD.

## 1. Introduction

Autism spectrum disorder (ASD) be the pervasive developmental disorder affecting the overall psychological growth of the person, presenting as a lifelong condition, and becomes major social stigma worldwide in prevalence rate of 1 in 59. In India, more than 3 million people affected with ASD in an average. The socio-culture of India, confirm to social laws, valued social relationships, mutual love and respect. However, Autistic people have problem in social communication like strange, socially deviant behaviors odd to the society, isolated in nature, fail to make and maintain relationships; hence become the significant issue in the major human resource country [32,33]. However, daily advancements in scientific studies on autism therapeutic procedures, diagnosis play a major role in the success. Even the availability of many screening and diagnostic tools internationally for ASD, those be socio-culturally irrelevant to Indian setting, many standard tools are patterned and costly, re-

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quires training and expertise to utilize. The development of user-friendly, indigenous screening and diagnostic tool will rectify the difficulties. The less awareness of autistic features among parents and professionals directed towards identification delay, even identified early, seldom lead to early intervention due to cultural beliefs and availability of few trained professionals at Indian scenario.

The article discussed briefly about Autism Spectrum Disorder and various difficulties in early identification and intervention of ASD in India. In addition, briefly evaluate the accessibility and validation of various screening and diagnostic tools in practice at India.

## 2. Materials and Method

An intensive literature survey conducted with various standard textbooks, monographs, and articles and indexed journals through online. The ASD features outlined and documented difficulties at recognition and intervention within India. In adding together, meticulous search for development and validation of various indigenous Indian diagnostic tools and other culturally related ASD screeners with appropriate articles. The real world survey, discussion with experts and people relating with autistic community also be the input of the study.

## 3. History and Prevalence

In 1943, Dr. Leo Kenner identified 11 cases of'Autistic disturbance of affective contact' as a congenital neuro-developmental disorder, have 'congenital inability to relate with people in a natural way and unusual response to the environment'. At the same period Dr. Ronald, a pediatrician practicing in Darjeeling, India identified and describes the signs and symptoms of 'Difficult child' similar to autism [47]. Around 1980s some psychiatrists in India got diagnosis of 'autistic children' commencing from abroad and spread awareness of the condition. By late 90s, obvious number of autism organizations begins to developing and now a day, many ASD specific intervention centers accessible in India.

According to primary epidemiological study by Victor Lotter in 1996, prevalence of 4 to 5 in 10,000, children among entire 8 to 10 years old population, afterwards 60 out of 10,000 children be autistic among 8 years old population. In 2007 an average of 1 in 800 to 1000 children were identified, WHO's study on 2013 there are 1 in 160 persons are suffered with ASD, but currently (2018) alarming increase of 1 in 50 to 60 children with ASD [61]. Among gender ratio, boys affected more in the range of 5 to 6 boy: one girl ratio [17]. The INCLEN's survey shows, the prevalence of 1 in 125 children of 3-6 years and 1 in 85 children of 6-9 years identified, and 0.90% in rural, 0.6% in hilly, 1.01% in urban, 0.1% in tribal, 0.61% in costal population of India [22,35,44]. In spite the fact, vast number of population remains undiagnosed and misdiagnosed under some other conditions.

## 4. Etiology and Clinical Features

Even the cause still uncertain, genetic, environmental and immunological factors assumed as the reasons behind. May prenatal and postnatal causes like consanguineous marriages, aged parents, maternal malnutrition, complicated labor, premature births, low birth weight, fetal distress and neonatal asphyxia are the risk factors for ASD and other developmental disorders [20,33]. These factors are widespread in developing country like India.

ASD frequently present as deferred speech and communication, developmental hindrance, being absorbed in personal world, deprived eye contact and remains isolated. Inappropriate non-functional use toys and objects like licking, spinning, banging, and breaking; Stereotypic motor behaviors like hand flapping, finger flickering, body rocking, spinning; lack of imitation and imaginary play etc. Sensory abnormalities include hypo/hypersensitivity to sounds, lights, touch, pain etc. The spectrum often co-occurs with intellectual deficiency, ADHD, seizures and other disorders.

According to DSM V diagnostic criteria, ASD present with at least 3 social communicative deficits and 2 restricted/ repetitive behaviors; those deficits must be identified at early developmental period with significant impairment in social occupational functioning, which are not explained by intellectual disability or global developmental delay. In addition, graded on severity level as 1, 2, 3 according to the requirement of social support [54].

Socio-communicative deficits include, difficulties in socio-emotional reciprocity, failure in conversation and unusual communication like pronoun reversal, echolalia, reduced sharing of interests, emotions or affect and failure to initiate social interactions. Deficits in non-verbal communication like failure to make eye contact, failed to look other's face, lack of appropriate gestures and facial expression, complexities in developing, maintaining, understanding relationships, difficult social adjustments, failure to make friends, lack of peer interests and lack of imitation and imaginative play.

Restricted, repetitive pattern of behaviors and interests includes, stereotyped repetitive motor mannerisms like hand flipping, finger wiggling, toe walking, lining up of toys, insistence on sameness, inflexible adherence to routines, extreme distress to small changes, highly restricted fixated interests like stares in to space, spinning fans and



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wheels, looking things in unusual angles. Hypo or hyperactive responses to sensory inputs like sounds, light, texture, smells, movements and apparent indifference to pain and temperature also expressed.

## 5. Genetics and Neurobiology

Globally, various studies demonstrate the genetic background of ASD, more than 100 genetic and genomic changes identified. Emerging studies shows associations of genetic environmental factors with de novo (new) mutations and polymorphisms. The chromatin modification, synaptic proteins, fragile x mental retardation protein and rare de novo variations like CNV (copy number variations) play a major role in pathophysiology of ASD. The fragile x mental retardation and tuberous sclerosis are the major associated genetic conditions with ASD. Family and twin studies show 60- 90% association among blood relatives. Various population and family based studies made in India to identify the association of ASD loci on Chromosome MicroArray (CMA) including engrailed-2 (EN-2), RELN, ITGB-3, SLC6A-4, TPH2 etc. However, there is no conclusive evidence on specific genetic involvement on Indian population [13].

Neurobiological studies show the evidence of autistic features early within initial intra uterine life itself. Infant Brain Imaging Studies (IBIS) show early signs of developmental disturbance in social part of brain with-in 3 to 6 months of age. Most of autistic child has enlarged head and brain size than typical children. The enlargement in gray and white matters of brain with reduced neuronal thickness and blocked axonal fiber development identified. The microstructure abnormality of the fibrous bundle associated with visual orientation leads to sticky visual attention and consequently reduced eye tracking. There is disproportional enlargement of frontal and temporal lobes and early overgrowth of amygdale a structure vital for emotional processing and memory. Functional MRI (fMRI) studies shows some regions of brains are hypo/hyperactive in autistic child. Hypo activity of amygdale and limbic system,(the reward system)responsible for learning, early sensory emotional processing leads to poor learning and social difficulties in autistic child. Under activity of fusiform gyrus, responsible for visual image processing leads difficulties in face recognition. The above factors together cause difficulties in person's association with socially relevant interactions.

Recent studies address the importance of mirror neuronal system (MNS) in brain's constellation, accountable for perception and implementation of the specific body movements [29,39,58]. MNS helps the person to imitate action what he observed, and contribute to theory of mind abilities related with learning, language abilities and understanding of action and intention of others. Mirror neurons in anterior insula and anterior cingulate cortex are accountable for emotions and empathy. MNS of posterior part of superior temporal sulcus responsible for social perception of non-verbal cues like facial expression, gestures, and eye gaze direction, understanding the intention of others. MNS of orbital prefrontal cortex and medial prefrontal cortex be dependable for understanding the value of rewards in emotional learning. MNS of inferior frontal cortex near broca's area acts as fundamental for language development and imagination. By the mirror neuronal activity, the child smiles in response to mother's smile, be the first socio-communicative pace. The site, size and quantity of mirror neurons connected with acquisition of social skills; insufficiency or the thinner layer of mirror neurons believed be the cause for autism spectrum disorder. Females have more mirror neurons than males, may fall out reasonably more number of autistic male than female.

## 6. Inevitable Early Identification

The child's growth in usual be the continuation of various periods of rapid changes on distinct areas of development; these are interdependent and independent in nature. The critical vulnerable periods show increased activity of certain parts of the nervous system; provide the opportunity for maximal growth and be effective on restructuring the neuronal system. Though the neurons developed fully at birth, the neural pathway development depends on environmental stimulation; because of the child's repeated exposure and experimenting with the environment, new neuronal synapses formed. Such a neural pathway interacts with genetically controlled proteins and enzymes, headed for neuronal parts of brain responsible for special functions like motorist functions, language and perceptual functions.

The early years of child's life, be crucial for the formation of bulk of neuronal synapses. At the age of 2 years, the child has twice the number of synapses as an adult, and at 5 years, the brain development completes 95% of adult brain size. However, after 10 years the brain involves actively in destroying weakly formed synapses, the under stimulated pathways guides atrophy of brain part unused. However, the developing brain has the ability to plasticity; our brain can compensate functions by forming alternative neuronal pathways. During first years of life, the child's nervous systems actively interrelate with environmental stimulation through gene induced neuronal synapses; more than 50,000 genes have capacity to reshape themselves by environmental stimulation. Hence, it is crucial to identify ASD within early years and activate

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alternate neuronal pathways of brain segments related with autistic difficulties and map intervention programs to prevent disuse atrophy [31].

Early recognition of ASD help the parents to identify and understand their child's handicaps, and gain knowledge about the course, clinical characteristics, emotional and cognitive behavioral factors influencing their course [1,26]. The Parents can overcome the feeling of anxiety about disability of their children, discover the ways to support and manage their autistic child [24]. Genetic counseling helps the parent's choice for next child, because 3 to 7% risk of ASD in siblings [28]. Early identification paves to early initiation of therapy; proven IQ gains, language improvement, enhanced social and behavioral skills, and overall reduction in severity of symptoms [18]. More evidence on early intervention at infancy and preschool age had great impact on outcome of children and families than intervention at school age. The expenditure on early intervention happens to lesser than on later age special education, crime, welfare and other expenses [4,8].

## 7. Identification Intricacy

On early years, the low prevalence and less awareness of ASD features or the condition identified with some other disorders like mental retardation, language disorder etc. The parents concern barely at verbal delay on comparing with typical developing children, around 2 years of age; never consider early because, most autistic children with normal physical and motor development [19,20]. Several children may have good ability on reciting rhymes and memorizing things, may mask the social language deficit. Indian cultural norms intend the quiet child as well-behaved, trouble-free child and Ignores the self absorbed, secluded child as good, which may leads delayed identification. On rural and lower socio economic areas, some hyperactivity and low adherence to social norms be unconsidered. The Parents often concern about language delay, hyperactivity, temper tantrums, bizarre body movements, problem in eating, sleeping, toilet training and other medical conditions like seizers; thinking about social symptoms only after prodding [57,59]. At educational scenario, difficulties in language use, group activity, peer relationships and hyperactivity often reported [35].

Owing to the variability of knowledge about ASD features among medical people, nearly all hospital setting chiefly concerns the moderate or severe symptoms and ignores the few mild featured children [62]. Practicing at the most populated country, numerous primary care physician/pediatricians often concerns medical problem primarily and identified behavioral or developmental problems later on with their busy schedule [23,27]. The majority of parents frequently changing their consultants make it difficult to diagnose at single visit. The tribulations of misdiagnosis, incomplete diagnosis and non-referral contribute delayed diagnosis at the medical sphere of influence [9,10].

## 8. Screening and Diagnostic Implements

NHS, UK's MeASURe program identified more than 130 early ASD screening and diagnostic tools available internationally [37]. Yet, very few available at Indian practice, like M-CHAT(R/F), CARS, ADOS, ADI-R, Indigenous Indian tools ISAA, INDT-ASD and AIIMS modified INDT-ASD etc. A number of people employ tools like VABS, DP-III, VSMS, ASQ, SRS, SCQ, SCDC, ABC etc. SCDC and SCQ available as translated version in Indian languages Hindi and Bengali [11,48,49]. In addition, few screening and diagnostic tools available for free download like M-CHAT-R/F, ISAA, INDT-ASD, PDDST-II, ABC, ESAT, ITC, SCQ, SRS, CSBS-DP, ASD parent interview, and standard diagnostic manuals DSM-V, ICD-10 be accessible for reference. The Indian academy of pediatrics recommends the M-CHAT, SCQ and Trivandrum Autism Behavior Checklist as intial screeners; the diagnostic tools like CARS, ADOS, ADI, INDT-ASD, and ISAA for diagnosis of ASD [12]. However, nearly all of the screening and surveillance tools depend on parental observation and responses; therefore, the legitimacy varied depends on parental understanding. The standard tool should have high sensitivity that could not miss the true positive cases and high specificity, which could avoid true negative cases. Nevertheless, the reliability, validity and measurement properties of every instrument in practice vary with each other.

### 8.1 Modified Checklist for Autism in Toddlers, Revised, with Follow-up M-CHAT(R/F)

The M-CHAT(R/F) be utilized as initial ASD screening implement for 16 to 30 months old children, the two stage early screening tool contains parental questionnaire and screened positive cases can be referred for further diagnostic evaluation. The tool initially developed by Robin et al. [46] as a modified version of the CHAT [46], named M-CHAT with inclusion of early socio communication impairments, repetitive behaviours and sensory abnormalities. Diana Robins, Deborah Fein and Marianne Barton (2014) revised as M-CHAT (R/F) with accompanying follow-up session [45]. Available on free download and as translated version in many Indian languages like Hindi, Bengali, Kanata, and Tamil. The M-CHAT developed as parent report screener and not at all for clinician. However, the majority of the pediatricians habitually utilize with



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general pediatric population, to discriminate between developmentally delayed children and child with ASD signs and symptoms. The instrument can more over used as a second stage screener, and the good number screen-positive can confidently referred for early evaluation and intervention programs. The universal screening implementation of M-CHAT(R/F) can lower the age of ASD diagnosis by 2 years compared with recent surveillance findings and increases time accessible for early intervention. It recognized 47.5% risk of autism and 95% as risk for developmental disorders. Yet, the tool could not used as a diagnostic implement, because it relies on self-report questionnaires, the possibility of under/over estimation may more depend on the individual's responses. A number of pediatricians feel it could under identify cognitive, emotional and behavioral features amongst children. In addition, the tool has some real time examples unsuitable for Indian cultural backgrounds; necessitate modifications to implement on Indian community.

### 8.2 The Indian Scale for Assessment of Autism (ISAA)

The ISAA developed by a team of experts associated with the national trust, ministry of social justice and empowerment, and the ministry of health and family welfare, under the government of India [38]. The instrument developed primarily for disability certification and research purpose, be a valid and user-friendly implement for grading autistic population aged around 3 to 22 years and officially recommended ASD diagnostic tool in India. The ISAA is available on free download and as mobile application at The National Trust of India's website. Anybody can administer the tool with minimal training and proficiency within 20-30 minutes. The instrument used for multipurpose screening, grading severity, clinical diagnosis, intervention planning and monitoring purpose, being well suited for India like multicultural and multi linguistic country.

The tool developed based on CARS and has 40 items under six domains includes, social relationship and reciprocity; emotional responsiveness; speech, language and communication; behavior patterns; sensory aspects and cognitive component [38]. The responses rated with 5-point likert scale based on increasing severity. A score of <70 indicates no autism, 70-106 (mild autism), 107-153 (moderate autism), and >153 (severe autism). The criterion validity of ISAA was significant in comparison with the CARS ($r = 0.765$, $p < 0.001$), Internal consistency and reliability (Cronbach's coefficient alpha) were significant and were comparable to CARS (Cronbach's alpha 0.932 $p < 0.001$). Each ISAA item was highly correlated with the total score, Inter-rater reliability ($r > 0.83$) as well as test-retest reliability after three months was satisfactory in a sub-sample ($r > 0.89$). A cut off score of 70 showed high and balanced sensitivity and specificity between autism and the group without psychiatric diagnosis, as well as between autism and the MR group. Receiver Operator Curve (ROC) analysis confirmed the discriminate ability of ISAA (Area under the curve, AUC = 0.931, SE = 0.009 using the cut off score of 70). The tool originally claimed to have 94.3% of sensitivity and 92% specificity.

According to Mukhergee, et al. study on 2-9 years old children [38], some of the test items are unsuitable for younger children. Some items shows overlapping content, ambiguous phrasing, and some features are normal variation of developing children considered as deviant. On construct validity, Pearson correlation coefficient(r) was acceptable in only social and emotional domains and had sub-optimal value for other domains. Test-retest and inter-rater reliability was 0.93-0.99and 0.99. The level of agreement with CARS was low. On scatter diagram plotted between ISAA and CARS total scores showed maximum clustering around 70-80 scores of ISAA. The study shows 93.3% sensitivity, 97.4% specificity of ISAA scores with good reliability and validity among age cut-off of 4.5-year children. Yet, the diagnostic accuracy of ASD among 2-9 years old children limited up to 40% only and categorization of severity was unsatisfactory, have evidence of poor agreement with CARS and absence of clustering around ISAA scores of >153. In common, positive symptoms (overt behaviours) easily identified and negative symptoms (absence of pro-social behaviours) often ignored. Hence, the both could be included in the tool like ISAA developed for wide range of applicability, because it probably leads to the suboptimal construct validity. Hence, it requires further analysis and evaluation and may not possible to use ISAA for assessing the severity of autism between 2 - 9 years old children [5,41].

### 8.3 INDT-ASD (INCLEN Diagnostic Tool for Autism Spectrum Disorder)

INDT-ASD is the indigenous Indian instrument developed by the INCLEN (International Clinical Epidemiology Network) trust international with the team of experts in INCLEN-NDD Project [22,60]. The tool based on DSM- IV TR, it can diagnose and differentiate pervasive developmental disorders like Autism, Asperger's syndrome, Rett's syndrome, Childhood disintegrative disorder, Pervasive developmental disorder - not otherwise specified. The tool has two sections; section A contains 29 parental questions and corresponding behavioral observations of the interviewer with three response options yes/no/unsure or not applicable. The tool has three sub categories in-

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cludes social interaction, social communication, restrictive and repetitive behaviours, each category has four items. Each item contains various descriptive questions related to the caption. Section B scored responses of section A and Six out of 12 items diagnose ASD. It will take 45 – 60 minutes to administer and score the responses in an average.

On juneja, et al. study on 2-9 years children [22], The INDT-ASD's diagnostic accuracy being good [AUC=0.97 (0.93, 0.99), P<0.001], and have Sensitivity 98%, specificity 95%, PPV (positive predictive value) 91%, NPV (negative predictive value) 99%. The Cronbach's alpha coefficients for internal consistency (0.96) being high indicates the symptoms cluster of INDT-ASD were homogenous and good agreement with DSM-TR. The instrument has high convergent validity with CARS (r= 0.73, p=0.001), and divergent validity with SBIS (standford-binet intelligence scale) showed moderate negative correlation (r= -0.37, p= 0.004). The results show the CARS and INDT-ASD theoretically related with each other; SBIS was theoretically different in its IQ measures. The study conducted at the tertiary care hospitals, could not represent the general population, so a community-based study is required. In addition, the instrument validated for 2-9 years old children may not capture less than two years old. The implement developed based on DSM- IV TR and could not cover the sensory symptoms, impairment of daily functional activities and early onset of symptoms. Hence, necessitate upgrading with DSM-V. However, the tool differential diagnoses ASD with other conditions like ID (intellectual deficiency) it could not grade the severity of autism.

### 8.4 The AIIMS Modified INDT-ASD Diagnostic Evaluation for ASD

The AIIMS Modified INDT-ASD was the new tool developed by Sheffali Gulati et al. at All India Institutes of Medical Sciences (AIIMS) beside with INCLEN group [52]. The team used pool of items from CARS (Childhood Autism Rating Scale), M-CHAT (Modified Checklist for Autism in Toddlers), and ABCL (Autism Behaviour Checklist) through modified Delphi technique; and developed as the upgraded version of INDT-ASD as per DSM-V specifications. The instrument has two sections (Section A and Section B). Section A has 28 questions to address seven items. Of which three items in the domain of social communication and interactions and four items in the domain of restricted repetitive pattern of behaviors and activity. In this modified form, the items to define sensory symptoms moreover included. Each items validated with responses yes/no/unsure by assessor/interviewer and behavioral observations of the clinician; Section B analyze the score of Section A. In addition, Section B has two mandatory items of 'onset at early developmental period' and 'impairment in daily functioning' - a prerequisite for the diagnosis of ASD. The tool could not require expertise and training to administer; will take 25 to 30 minutes to administer and get results. The AIIMS Modified INDT-ASD validated with 225 children ( age group 1 to 14 years) presented in International Conference on Autism & Neurodevelopment Disorders, and claimed the psychometric properties of Sensitivity: 97.4% [90.9% to 99.3%] Specificity: 89.5 % [80.6% to 94.6%]Positive Predictive Value: 90.2% [81.9% to 94.9%] Negative Predictive Value: 97.1 % [90.2% to 99.2%] Diagnostic accuracy: 93.4% [88.3% to 96.4%]. Hence, it considered as a valid tool to get the DSM V based ASD diagnosis. The tool developed as user friendly and existing in various Indian languages like Hindi, Malayalam, Kanata, and English etc. offered as a mobile application too. Therefore, be the suitable implement for socio-culturally varied country like India. Yet, the tool could not assess the severity of ASD, and ignoring the few autistic features present in the notably abnormal children and labeling them as non-ASD. Here is the necessity of further research and upgrading of the instrument.

### 8.5 CARS2 (Childhood Autism Rating Scale 2)

The Childhood Autism Rating Scale (CARS) [7,50] has available in use since 1971, developed by Eric Schopler, Robert Reichier and Barbara Rochen Renner. The CARS be the observation based rating scale, applicable for children 2 years and above, rates the child's abilities and behavioral characteristics against the typically developing child. The early tool (CARS) allows observations and ratings by the trained diagnosticians only. Subsequent edition on 1988 allowed a wide Varity of trained professionals to use reliably. The second edition CARS 2 has added new features and data analysis [37]. It contains two versions CARS2-ST (Standard Form), CARS2-HF (High Functioning) and CARS2-QPC (Questionnaire for Parents and Caregivers). The tool was same as CARS, the 15 items scale with 4 response categories normal, mild, moderate and severe and 3 intermediate responses as 1, 1.5, 2, 2.5, 3, 3.5, and 4. Of which, rating 1 for age appropriately normal child, 2 for mildly abnormal, 3 for moderately abnormal and 4 for severely abnormal autistic child. The cumulative Scores range from 15 to 60 for the 15 items. The scale classify the severity of ASD features for the individuals based on total raw scores into, minimal-to- no symptoms of ASD, mild-to- moderate symptoms of ASD, and severe symptoms of ASD depends on total scores obtained. The total raw scores can convert into T-scores



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and corresponding percentile rank. It indicates the level of correspondence with individuals of ASD.

The CARS-ST contains same items and clinical cut-off as of old CARS, which indent to use for less than 6 years old children or 6 years and above children with IQ score less than 79 and having impairment in communication. The diagnosis of severity in CARS2-ST depends on total raw scores 15-29.5 as minimal to no ASD (15-27.5 for age 13+), 30- 36.5 as mild to moderate symptoms of ASD (28-34.5 for ages 13+), and the score more than 37 as severe symptoms of ASD (35 and above for ages 13+).

The CARS2-HF developed to identify High Functioning Autistic individuals (HFA) and Asperger's disorder. Used to assess individuals with IQ 80 and higher, or children aged six and above with good verbal skills and fluent communication. The 15 categories in CARS has modified in CARS2-HF to provide information to the clinicians about the socio communicative deficits, behavioral excesses, and cognitive sensory deficits in HFA and Asperger's disorder. The CARS2-HF rated similar to CARS2-ST, based on behavioral observations, and comparison with typical developing child of same age. Scoring also similar to CARS2-ST for 15 categories, but severity group scores differs with CARS2-ST, the score range 15-27.5 for mild ASD, the scores 28-33.5 for mild to moderate ASD and severe category scored 34 and higher.

The CARS2 contains CARS2-QPC in addition, to rate parent's/caregiver's responses. The Questionnaire for Parents or caregivers is an un-scored form, designed to accompany CARS2-ST and CARS2-HF. It gives information relevant to each 15 categories, helps the professional to understand the overall strengths and weaknesses of the individual on evaluation. Moreover, the newer tool is easier to use than older version. In addition, it differentiates ASD with other conditions like intellectual deficiency.

The test review on CARS2 by schopler et al. claims, the reliability of internal consistency of CARS2 with the original CARS shows 93% for CARS2-ST, 96% for CARS2-HF. The item correlations ranged from 0.43 to 0.81 on CARS-ST and from 0.53 to 0.88 on the CARS-HF. The validity of internal structure for both CARS2-ST and CARS2-HF, the items rating correlation is moderately high, ranging from 0.42 to 0.77 for CARS2-ST and 0.40 to 0.79 for CARS-HF; the CARS2-ST has 88% sensitivity and 86% specificity, the CARS2-HF has 81% sensitivity and 87% specificity. The content validity of both forms consistent with five core criteria of diagnostic systems [56].

On Russell et.al study on the diagnostic accuracy, reliability and validity of CARS among Indian children with ASD [50], shows the psychometric properties acceptable with Indian population as that of western and other non-western population. The study on children and adolescences suspected with ASD in tertiary care and teaching hospital at south India shows, the CARS threshold score of greater than 33 considered as an ideal cut-off score for diagnosis of ASD among Indian population. The first ever validation of CARS against ICD-10 shows the high concordance rate (82.52%; Cohen's kappa=0.40, P=0.001) in classifying autism. The AUC 0.81 (P= 0.001) for ROC curve shows the overall diagnostic accuracy of CARS was high. A score of > or =33 (sensitivity = 81.4%, specificity = 78.6%; area under the curve = 81%) suggests good psychometrics for the diagnostic use of CARS on Indian populations. The inter-rater reliability (ICC=0.74) and test-retest reliability (ICC=0.81) for CARS were good. In addition, the tool have the adequate face and content validity, demonstrated good internal consistency (Cronbach's alpha=0.79) and item-total correlation. There was moderate convergent validity with Binet-Kamat Test of Intelligence or Gessell's Developmental Schedule (r=0.42; P=0.01), divergent validity (r=-0.18; P=0.4) with ADD-H Comprehensive Teacher Rating Scale. The tool have high concordance rate with the reference standard, ICD-10 diagnosis (82.52%; Cohen's kappa=0.40, P=0.001) of ASD. A 5-factor items loading structure on factor analysis explained 65.34% of variance. However, the items total correlation that determines the role of each 15 items in entire test shows the items activity level and intellectual functioning were ineffective in contributing the total score. These items could also measure the intellectual deficiency (95%) and Attention deficit and Hyperactive Disorder (53%), the two more highly prevalent co-morbid conditions with ASD among Indian population. It suggests the hypothesis to exclude these items to improve the construct validity of the CARS. This hypothesis needs further research and testing.

### 8.6 PAAS (Pictorial Autism Assessment Scale)

Pictorial autism assessment tool (PASS) was the culturally adopted tool developed by Perera H et al. (2016) of Sri Lanka [42], the neighboring country have similar socio-cultural settings like India. The screening tool developed with 21 items as that of M-CHAT, having pictorial representation of the each items with photographs. The items explained in local languages Tamil and Sinhala with yes/no responses. While comparing with text only tools, it has good accurate response with parents, being user friendly and can administer within 15- 20 minutes. The study on the tool claims, 88.8% sensitivity, 93.3% specificity, and 95.2% positive predictive value and 84% negative predictive value [43]. Though the screening tool has its own advantages of including visual aid to understand the concept

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of the items, the tool tested to assess 18-48 months old children and could not test for its usability on the children above 48 months of age. Hence, show the limited applicability at particular age group.

### 8.7 CASI (Chandigarh Autism Screening Instrument)

Chandigarh Autism Screening Instrument (CASI) developed by Dr. Priti Arun and the team of professionals at deportment of psychiatry, Government Medical College and Hospital, Chandigarh, India [2]. The 37 items screening tool with north Indian regional language Hindi, developed as a parental screening questionnaire with dichotomous yes/no responses. The tool constructed based on DSM IV TR, and validated against M-CHAT and ABC (Autism Behavior Checklist). Developed to assess 1and half to 10 year old children. It takes 15-20 minutes to administer. The tool has 89.16% sensitivity and 89.13% specificity, positive predictive value 67.89% and negative predictive value 96.96%. The screener has the advantage of user friendly and native language tool, being self-explanatory, can administer by anyone without training. However, the tool needs to upgrade for DSM-V diagnostic criteria. Further evaluation needed with testing on larger community settings and has to translate in various other Indian languages.

As discussed, the majority of screening and diagnostic tools available internationally may not be suitable for Indian socio-cultural situations, many implements are patterned and costly, difficult to adopt in different socio-economic status of India [55]. Numerous instruments need training and expertise to use, and here, the smaller amount of trained personals to work on various rural and urban settings of India. The available above-mentioned indigenous Indian tools and others have their own advantages and limitations, requires further research and develoment in the field [6].

## 9. Intervention obscurities

At Indian scenario, many practical difficulties including delayed identification and difficult parental acceptance, hesitation to start therapy and less number of trained personals to provide therapy especially at rural and remote areas. Even though, wide increase in awareness; more number of cases remains undiagnosed and devoid of the required crucial intervention [8,51]. Early appropriate screening and initiation of intervention can improve outcomes in these children [16,53]. Yet, the mean age of first consultation in children with ASD 32.5 months and intervention initiated at 52.75 months [34]. The limited availability of ASD specific governmental organizations, less availability of standardized therapeutic methods for intervention, the cost of private intervention programs become more burden to the parents of middle and lower socioeconomic group [3,21].

Though the international insistence of various ABA (Applied Behaviour Analysis) based therapies as standard [30], the applicability restricted due various socioeconomic, educational, cultural and healthcare standards in India. Hence, parent mediated, home based therapies are the most suitable mode of therapy in Indian setting due to the scarcity of professionally trained persons; be economically advantageous, available in practice early before the insistence in modern literatures, provide intervention at naturalistic setting at the convenient time [40,44]. The available few governmental organizations can train parents on periodical basis to act as a co-therapist. Individualized therapy plan according to child and family centered needs are to be developed; and the professional can monitor the outcome on regular basis. However, mother being the primary care-taker, busy with all her household chaos and profession cannot contribute the therapy. Raising a child with disability leads a tremendous stress on parents and family. On the other hand, the joint family system in India can act as a great support to the suffering child, and facilitate therapy in good manner through grant parents, brothers, sisters, cousins etc. Yet it is not possible in low socio economic families, whom themselves lack basic education, or suffer from autism like traits, depression, anxiety and other psychiatric disorders, [14,15]. However, it is essential to incorporate multi-centric evidence based practices and research on comprehensive method to improve the available interventions. Until now, there is no proven evidence of cure for ASD, various pharmacotherapies in practice for behavioral difficulties and co-morbidities. In addition, India being the land of Yoga and Ayurveda, various AYUSH based therapies are available as optional. Yet, the scientific proving and research on various therapeutic practices are essentially progressing in India.

## 10. Conclusion

Autism Spectrum Disorder remains as life-long condition, early intervention can improve the symptoms and aids independent living with educational and vocational achievements [25]. At Indian sub-continent, varied socio- cultural, economic, healthcare and literacy ranges contribute the factor deciding untimely identification, diagnosis and management. It requires generating immense awareness and association among parents and professionals. Policymaking necessitates added training and educational programs for professionals and people handling autistic children. Pro-



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spective research imposes on cultural, language specific, indigenous screening and diagnostic instruments with rationalized implementation for Indian gamut of population. The advancement of varied cultural specific behavioral and environmental modified intervention program necessitates the betterment of Indian autistic community.

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ARTICLE

# Comedy Movies and Stock Returns of Locally Headquartered Companies: Evidence from China

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ABSTRACT

We utilize data on comedy moviegoers from 18 cities in China to investigate the impact of the positive mood triggered by these movies on the stock returns of locally headquartered listed companies. We find that although these movies have no relation to investment itself, the sentiment triggered by these movies could affect the risk decision making of investors. Moreover, the stock returns of locally headquartered companies become significantly negative after comedy movies are screened in their respective cities. These results support the mood maintenance hypothesis. This research also provides new evidence for the presence of home bias in capital markets.

**JEL Classification: G11; G12**

## 1. Introduction

Theoretically, optimal portfolios must be on the efficient frontier of risky assets, and the investment proportion of each risky asset is currently determined only by its contribution to the total risk of the portfolio and has nothing to do with the subjective judgment of investors. In 1952, Markowitz [41] proved that such portfolio can take the smallest variance (i.e., risk) at the same time to obtain the maximum expected return. However, in capital markets, the proportion of risky assets in the portfolios of investors tends to deviate from the weight of the optimal portfolio. One typical anomaly in these markets is home bias, which means that investors will disproportionately trade domestic stocks and prefer to hold or purchase shares of locally headquartered firms [13,20,29]. Previous studies find that home bias is mainly observed in international investments. Although investors are aware of the benefits of diversifying their international asset investments, they tend to prefer domestic stocks in their allocation of domestic and foreign equity portfolios. French and Poterba[50] found that investors in the US allocate nearly 94% of their funds to domestic securities even though the US equity market comprises less than 48% of the global equity market. Home bias also exists in other capital markets [13], and scholars have examined such problem from the perspectives of domestic and foreign capital flows, tariffs, and transaction costs constraints [5,46], the differences in purchasing power parity [12], the international boundaries or differences in the characteristics of capital markets, and the geographical proximity [1,30,34]. These explanations are mainly based on market segmen-

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tation and asymmetric information. Market segmentation restricts the funds in and out of borders and results in tax and accounting differences in some countries, thereby motivating investors to hold domestic stocks. Asymmetric information states that investors will neglect assets portfolio theory, choose familiar stocks, and buy domestic stocks because they can easily obtain more information about these listed companies from the local news media, employees, managers, and material suppliers [23,45]. Graham *et al.* [19] examined home bias from the perspective of subjective adjustment and posited that the competitive advantages of the subjective perception of investors may affect the investment bias. For example, those investors who think that they are proficient in overseas asset risks and returns tend to invest in more overseas stocks, while those who are not familiar with international investment will avoid investing in overseas stocks. Later studies show that home bias may also exist in a domestic capital market without any capital flow restrictions and tax discrimination. For example, Loughran and Schultz [40] found that the time zone in the headquarter city of a listed company will affect the trading behavior of its stocks. If the headquarter city of a company is experiencing a snowstorm, then the trading volume of its stocks will significantly decrease. Similarly, the stock trading volume of those companies that are headquartered in cities with many Jews will substantially decrease during Yom Kippur holidays. However, the work of Loughran and Schultz [40] may be special in a sense because the continental US is divided into four time zones while stock exchanges and brokers are usually gathered at New York. When the NYSE opens its quotation at morning, the investors located in the Pacific Time Zone (such as California) are sleeping and unlikely to submit their orders, thereby generating a difference in trading volume.

Therefore, home bias and the factors that affect such are worth investigating in those areas without any cross-border investment restrictions, tariffs, and domestic time zone differences. To extend the findings from the literature, this paper examines home bias from the behavioral finance perspective. We take the number of comedy moviegoers from 18 cities in China as a proxy for investor sentiment to study how the mood of investors in a city as triggered by these movies can affect the stock returns of those listed companies that are headquartered in the same city. The stock returns of locally headquartered companies in 17 cities significantly decrease in the trading day that follows the screening of such movies. The reduction in the stock returns of 15 out of these 17 cities is at least 5% significant. Similar results are obtained when the number of comedy moviegoers is taken as the explanation variable, that is, the reduction in the stock returns of 16 cities is at least 5% significant. An analysis based on the equally weighted returns of each city reveals that screening a comedy movie will significantly reduce the stock returns of a city by 0.0647% at the 5% level, and the annualized return will decrease by 13.425% when risk-free returns and transaction costs are excluded. Therefore, the positive emotions of investors as triggered by comedies have a significant negative impact on the expected return of local stocks, thereby proving the existence of home bias in the domestic capital market and verifying the mood maintenance hypothesis (MMH), which posits that after feeling a positive emotion from watching a comedy movie, investors attempt to maintain such positive emotion by avoiding risky investment activities and adopting conservative investment strategies, thereby reducing stock returns.

Our study contributes to the literature in several ways. First, we find that local bias may exist inside the capital market of a country. Previous studies suggest that investors may show investment bias in international capital markets because of cross-nation investment restrictions and information asymmetry. If we limit our sample to the domestic stock market, then we can effectively control the impacts of cross-nation investment restrictions, accounting principle differences, information acquisition differences, and risk-free return differences, thereby facilitating the analysis of a clean investment environment.

Second, we further investigate how the emotions of investors affect capital pricing as suggested in several studies [2,3,7,22,48,49]. Some psychological experiments and empirical studies show that emotions can affect the behavior and decisions of humans and make them irrational. Baker and Wurgler [2] and Brown and Cliff [7] argue that if investors hold a highly positive sentiment, then shorter years after IPO, lower market equities, higher volatility, and higher growth could result in lower returns in the future. Brown [6] and Lee *et al.* [38] explained the impact of investor emotion on stock market fluctuations. They took economy or investment survey data as indices of consumer confidence, used investor intelligence to measure the emotions of investors, and used proxies that were indirectly related to investment to construct a composite sentiment index. Meanwhile, Baker and Wurgler [2] used closed-end fund discount, turnover ratio, number of IPOs, average first-day returns, share of equity issues in total equity and debt issues, and dividend premium to construct a BW sentiment index. Even if the factor that results in fluctuating investor emotions has no direct relationship with economic or investment fundamentals, this factor—as long as it changes the emotions and risk attitudes of investors—may change the decision-making behavior of inves-

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tors because their emotions can influence their investment decision factors, including risk tolerance, risk perception, risk preference, and information processing procedure for generating expectations [31,44].

Third, although watching comedy movies has nothing to do with capital market investments, these movies induce positive emotions and the persistence of such emotions may force investors to adopt conservative strategies when making risky investments. Movies not only provide leisure but also have a profound impact on the social economy. Compared with other ways of expressing emotions, a film's sense of the screen and story can greatly affect people's emotions and thinking as well as generate a lasting impact on their emotions. Forgas *et al.* [18] investigated the social cognitive judgments of moviegoers before and after watching three types of films (e.g., comedy, tragedy, and action films), and their experiments revealed that these films had a strong impact on their emotions and that different types of movies could induce various types of feelings. For instance, moviegoers become highly anxious, bored, or uneasy after watching a tragedy movie yet become relaxed, happy, and at ease after watching a comedy movie [24]. The impact of movies on the emotions of moviegoers is highly concentrative and consistent. On the one hand, each movie conveys a specific theme and value. For instance, a comedy movie is generally relaxed and pleasant, a suspense movie makes people nervous and reflective, and a disaster movie makes people feel depressed. On the other hand, a film produces the same emotional impact on the same group of viewers, and this emotional impact has a certain degree of continuity and may even change the stock returns for the next day. Lepori [39] empirically examined the relationship between comedy movies and stock returns in the US market. By using the number of comedy moviegoers as a proxy for investor sentiment, Lepori found that the positive emotions triggered by comedy movies have a negative impact on stock returns.

Fourth, this study provides new evidence to support the MMH of Isen [25], who suggests that people tend to maintain a positive emotion by avoiding critical thinking and complex information processing. Kliger and Kudryavtsev [35] argued that people usually maintain a positive emotional state under such psychological influence and that their emotions can cause violent behavioral fluctuations when outside information is present. Previous studies have mainly tested the emotional hypothesis by conducting experiments. For example, Isen and Patrick [28] and Isen and Geva [26] sent small gifts to participants during an experiment to help them build a positive emotion. When these participants perceived a greater potential risk, their stake is smaller than that of neutral participants. Isen *et al.* [27] discovered that compared with the control group, the participants with a positive emotion hold highly negative and sensitive assessments on risk taking. Therefore, these participants show negative subjective motivations. Williams *et al.* [47] found that managers with positive emotions are very optimistic about risk-related uncertainty but are reluctant to take risks in real-world situations. This paper goes far from the experiment framework and mode by using real data to test MMH.

Fifth, previous studies have mostly focused on highly efficient developed capital markets where the stock price can quickly absorb information, such as in Lepori [39]. Emerging capital markets such as China have low market efficiency, and the presence of home bias in these markets warrants further research.

Similar to our work, Chang *et al.* [10] and Lepori [39] examined the effects of the National Football League (NFL) and comedy movies on the stock market, respectively. Based on the work of Edmans *et al.* [16], Chang *et al.* [10] examined the relationship between NFL results and the stock returns of locally headquartered companies, and found that both the victory and defeat of the local team would affect the future stock returns in NASDAQ. Losing has a more significant negative impact on the local stock returns than winning. This study not only confirms the existence of home bias but also shows that investor sentiment can affect the capital market. However, our research bears some differences from that of Chang *et al.* [10]. First, Chang *et al.* [10] examined the impact of sports on the emotions of market participants, while our study examines the influence of arts and crafts on these emotions. Sports and arts are two important collective activities in the history of human civilization that best reflect social civilization and activity. For example, the Olympic Games are still being played after their introduction in Greece over 2000 years ago, and the ancient Greek dramas "Agamanche" and "Prometheus" are still being performed for over 2500 years. These collective activities will significantly affect the mood of their audience as well as change their subsequent risk-taking behavior and judgments. Second, the results of one NFL game can only be used to observe the stock returns and trading activities at the cities of the host and visiting teams, while movies can be released at many cities simultaneously. Our research simultaneously investigates how the mood of moviegoers affects the stock returns of 920 companies in 18 cities. Third, although China roughly has the same land area as the US, this former only has one time zone and has a better control over the impact of time zone differences.

Our study also significantly differs from that of Lepori



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[39], who found a significant relationship between watching movies and stock returns. First, Lepori [39] calculated the number of comedy moviegoers by dividing the total box office gross income in the US by the average ticket prices. However, the differences in the ticket prices of the same movie across various cities may lead to inaccurate calculation results. By contrast, we directly count the number of people who are watching comedy movies. Second, Lepori [39] only examined the impact of comedy movies on Monday stock returns based on weekly data, while we analyze the influence of comedy movies on the next day's stock returns based on daily data. Third, Lepori [39] examined the impact of comedies on the market index returns, while we examine individual stock returns and their effects on home bias. By using the number of moviegoers in 18 cities, we study the impact of emotions on the investment decision-making behaviors of investors.

The rest of this paper is organized as follows. Section 2 describes the sample and presents the summary statistics. Section 3 examines the impact of comedy movies on stock returns. Section 4 presents the results of robustness checks. Section 5 concludes the paper.

## 2. Data and Descriptive Statistics

### 2.1 Taking the Number of Moviegoers as a Proxy for Investor Emotion

The demand for leisure and entertainment in China has increased along with the rapid development of its economy. With the increasing per capita income and intellectual property protection in the country, China's urban residents are increasingly becoming accustomed to watching movies in the cinema, thereby increasing box office revenues. As early as 2012, mainland China's box office revenues increased to 17 billion RMB (about 2.7 billion USD), thereby overtaking Japan as the world's second largest film market after the US. In 2013, the box office revenues and number of domestic moviegoers in China reached 21.8 billion RMB and 612 million, respectively, while the local box office receipts in 2014 reached a new record of 29.6 billion RMB. Watching movies has become an indispensable source of entertainment for urban residents. The influence of the Chinese movie market is growing and has penetrated into the daily lives of the Chinese people, thereby motivating researchers to study whether movies can affect people's emotions. Similar to Lepori [39], we use the number of comedy moviegoers as emotion-triggering events to analyze the impact of investor sentiments on China's stock market as well as to check if the local bias exists and if the mood maintenance hypothesis holds in this market. Lepori [39] focuses on the impact of screening comedy movies during weekends on the Monday returns of the entire US stock market. Based on Lepori [39], we examine the impact of screening comedies on the local stock market returns of China in the next trading day for three years. According to the *2012–2013 Chinese Cinema Development Study Report* from Chinese ENTGroup, the box office revenues of 18 major cities, including Beijing and Shanghai, account for more than half of the country total. Therefore, this paper chooses the number of comedy moviegoers in these 18 cities as a proxy for investor sentiment.

Given that the sample period of our investor sentiment proxy begins on March 19, 2012, we use March 19, 2012 to March 18, 2015 as our study period. We manually collect online ticket data on the number of daily comedy moviegoers in 18 cities from the National Film Score Network. According to the China Film Association [11] and the China Federation of Literary and Art Center (2014), online ticketing has become a mainstream method for selling movie tickets in China due to the popularity of the Internet and the widespread use of smartphones. Selling tickets online has many advantages over selling tickets in the cinema. First, online ticket prices are highly transparent and are 50% cheaper than those sold at the cinema. Second, selling tickets online can result in significant labor cost savings. Third, online ticketing allows moviegoers to attend online screenings, book their seats, and plan their entire moviegoing experience. Fourth, online tickets are ready to use and are dispatched at a shorter time compared with those sold in cinemas. Therefore, online ticket sales account for 50% to 60% of the total box office revenues in some large cities in China, such as Shanghai. According to the *2012–2013 Chinese Cinema Development Study Report*, the Chinese movie market is highly concentrated in urban areas, with the box revenues in cities accounting for 68.2% of the country total. Although the ticket sales data from the National Film Score Network cover about 50 cities in China, most cities, especially those with a small number of listed companies, hold few screenings and show few comedies. The relationship between screening comedy movies and the stock returns of local listed companies cannot be easily analyzed for those cities with few or no listed companies. Therefore, we only use the movie screening data of 18 cities that have many moviegoers and listed companies. These cities include Beijing, Chengdu, Chongqing, Dalian, Fuzhou, Guangzhou, Hangzhou, Kunming, Nanjing, Ningbo, Shanghai, Shenyang, Shenzhen, Suzhou, Tianjin, Wuhan, Xi'an, and Zhengzhou. According to ENTGroup, these 18 cities altogether generated a box office revenue of 9.7 billion RMB in 2012, accounting for 56.52% of the country total.

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We collect our data from the statistics page of the National Film Score Network website, which provides data on showing times, audience numbers, ticket prices, and box office revenues in each city. We only consider those movies that have been screened for over 100 times from March 19, 2012 to September 31, 2015 and excluded those movies that have been screened repeatedly during this period. We eventually obtain a list of 1,077 movies. Those movies that show similarities in their narrative elements are classified into a single "type." Movie types are commonly classified based on their scenes, emotions, and forms. Specifically, movies can be classified into crime, history, science fiction, sports, war, and western in terms of scene, action, adventure, comedy, drama, fantasy, horror, romance, and thriller in terms of emotion, and cartoons, brochures, documentaries, music, and short films in terms of form. As the local version of IMDb, an online database of films, television shows, and video games, Mtime is the most comprehensive film and television drama database in China that classifies movies based on their scene, mood, or form. We follow the same classification in our study to identify comedy movies. To ensure the effectiveness and rationality of our classification, we refer to the movie reviews posted on Mtime and Movie Douban, another famous film website in China. We classify a movie as a comedy if it is also classified as a comedy in both of these websites and if more than 80% of the movie reviews from these websites describe this movie as funny or humorous. We collect the names, types, showing times, and scores of 1,077 movies from Mtime and Movie Douban and eventually obtain a list of 246 comedies. Lepori [39] studied the impact of weekend (Friday to Sunday) comedy movie attendance on Monday stock market returns. Following Lepori [39], we use the daily number of comedy moviegoers in every city, *comedy*, as a proxy for next day's investor sentiment to analyze the impact of screening comedies on the daily stock return of locally listed companies. Given that no stock trading activities are conducted on Saturdays and Sundays, we use the number of comedy moviegoers during these two days as a proxy for investor sentiment. If two or more comedies are being screened on the same day, we use the total number of moviegoers who watched these comedies as a proxy for investor sentiment.

## 2.2 Stock Variables

We obtain a list of 920 companies that are located in the selected 18 cities and are listed on the A-share markets of the Shanghai Stock Exchange (SSE) and the Shenzhen Stock Exchange (SZSE) (see Table A1). By the end of 2014, these 920 listed companies accounted 50.06% of all listed companies at SSE and SZSE, whereas their market value accounts for 51.77% of the total market value in these exchanges. We collect data on daily stock returns from the RESSET database.

**Table A1.** Listed companies, latitude, and residents of 18 cities

| City | Number of listed companies at the A share markets of SSE and SZSE | Latitude | Permanent residents (thousands) |
|---|---|---|---|
| **Beijing** | 159 | N 39.92° | 12,400 |
| **Chengdu** | 39 | N 30.67° | 7,570 |
| **Chongqing** | 34 | N 29.59° | 8,020 |
| **Dalian** | 23 | N 38.92° | 6,920 |
| **Fuzhou** | 26 | N 26.08° | 7,310 |
| **Guangzhou** | 50 | N 23.16° | 12,880 |
| **Hangzhou** | 54 | N 30.26° | 8,820 |
| **Kunming** | 19 | N 25.04° | 6,550 |
| **Nanjing** | 40 | N 32.04° | 8,170 |
| **Ningbo** | 31 | N 29.86° | 7,650 |
| **Shanghai** | 161 | N 31.22° | 14,280 |
| **Shenyang** | 16 | N 41.80° | 8,240 |
| **Shenzhen** | 138 | N 22.62° | 10,580 |
| **Suzhou** | 26 | N 31.32° | 6,530 |
| **Tianjin** | 30 | N 39.13° | 11,800 |
| **Wuhan** | 35 | N 30.52° | 10,170 |
| **Xi'an** | 23 | N 34.27° | 8,570 |
| **Zhengzhou** | 16 | N 34.76° | 9,110 |
| **Total** | 920 | - | 165,570 |

***Note:*** This table presents general information on the 18 selected cities. The number of listed companies is the number of A-share companies that are listed on the main boards of the Shanghai Stock Exchange (SSE) and Shenzhen Stock Exchange (SZSE). The population of permanent residents is the average resident population from 2012 to 2015. The population data of Beijing and Chongqing only include the urban resident population of these cities.

## 2.3 Control Variables

First, we use the number of daily moviegoers in the selected 18 cities, all, as a control variable. According to Lepori [39], box office revenues directly affect the income of a film production company, which means that an increase or decrease in the number of moviegoers may have an economic impact on the market value of listed movie companies and their stock returns. According to statistical data from SSE and SZSE, eight listed companies on the A-share market are directly related to the movie market, including Huayi Brothers (300027.sz), Bluefocus (300058.sz), LeTV (300104.sz), Huace Film & TV (300133.sz), Enlight Media (300251.sz), HualuBaina Film & TV (300291.sz), Ourpalm (300315.sz), and Beijing Bashi



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Media (600386.sh). Therefore, we use the number of general moviegoers as an explanatory variable to control the economic impact of movie screenings. In psychological experiments, the subjects are often asked to watch movie clips, but in real life, people can choose movies or other recreational methods (e.g., shopping and sports). Therefore, watching comedy movies may have a direct or indirect impact on the stock market. As a direct effect, comedy movies incite positive moods that can affect the decisions of their audience, while as an indirect effect, watching these movies can affect the emotions of their audience. Following Lepori [39], we control such indirect impact by controlling the number of moviegoers.

Second, we must control the effects of seasonal affective disorder (SAD), an emotion or mood disorder that is usually observed in days with shorter daylight, especially at the end of fall and at the beginning of winter. SAD is considered a form of depression with several symptoms, including insomnia, drowsiness, depression, anxiety, despair, fatigue, and distraction. Individuals with SAD usually demonstrate symptoms of mood disorders in days with shorter daytime and longer nighttime. Many economic studies have described the economic effects of SAD. For instance, Kamstra *et al.* [32] validated the impact of SAD on the stock market returns of some countries. SAD emerged as the most significant of the seven proxies for investor sentiment used by Dowling and Lucey [14] to analyze the impact of such sentiment on stock returns. Kramer and Weber [37] studied the relationship between the investment cash flow of mutual funds in the US and the onset and recovery of the SAD effect, and found that the cash flowed from the equity fund to the monetary market fund during fall and flowed in the opposite direction during spring. Following Kamstra *et al*. [33], we use the relative length of nighttime to measure SAD. Given that SAD is a mood disorder that is frequently observed in autumn and winter, SAD takes a value of 0 from March 21 to September 20 of each year.We calculate the SAD of each city according to its respective latitude (see Table A1).

Because the end of the tax year in China is 31 December, following Dyl *et al*. [15], we control the tax effect, $Tax_t$, which takes a value of 1 from the first trading day to the seventh trading day in each year, and takes a value of 0 for the other trading days.

## 2.4 Descriptive Statistics

A total of 726 trading days takes place from March 19, 2012 to March 18, 2015. Table 1 presents the number of general moviegoers, number of comedy moviegoers, and stock returns for the 18 selected cities. As shown in Table 1, 726 observations are obtained for both the general and comedy moviegoers. We compute the number of stock return observations by multiplying the number of listed companies by the number of trading days. Given that each city has a different number of listed companies, each city also has a different number of stock return observations. Each city has an average of 4,406 comedy moviegoers and 19,603 general moviegoers. The average and maximum number of general moviegoers in Beijing, Shanghai, Shenzhen, and Guangzhou are significantly higher than those in other cities. Beijing has an average of 89,809 daily general moviegoers (with a maximum of 677,430), which is nearly 50 times larger than that of Dalian (1,822). Shanghai and Shenzhen have the second and third largest number of daily moviegoers after Beijing, respectively. Among the 18 selected cities, only 8 have more than 10,000 daily general moviegoers, including Beijing, Shanghai, Shenzhen, Guangzhou, Chongqing, Hangzhou, Tianjin, and Kunming. Beijing and Shanghai have 20,727 and 10413 daily comedy moviegoers, respectively, both of which are far greater than those of Dalian, Fuzhou, and Shenyang.

**Table 1.** Descriptive statistics of 18 cities

| City | Variables | Obs. | Mean | Std.Dev. | Min. | Max. |
|---|---|---|---|---|---|---|
| **Beijing** | *comedy* | 726 | 20,727 | 40,031.62 | 0 | 481,603 |
| | *all* | 726 | 89,809 | 105,735.3 | 0 | 677,430 |
| | *R* | 107,951 | 0.001346 | 0.025823 | –0.10061 | 0.736 |
| **Chengdu** | *comedy* | 726 | 1,981 | 4,432.191 | 0 | 48,853 |
| | *all* | 726 | 9,328 | 14,796.28 | 0 | 135,174 |
| | *R* | 26,312 | 0.00142 | 0.02705 | –0.1004 | 0.731343 |
| **Chongqing** | *comedy* | 726 | 6,776 | 12,559.82 | 0 | 158,669 |
| | *all* | 726 | 32,259 | 35,565.58 | 0 | 229,215 |
| | *R* | 21,721 | 0.001383 | 0.029 | –0.10041 | 1.788624 |
| **Dalian** | *comedy* | 726 | 502 | 1,996.098 | 0 | 32,704 |
| | *all* | 726 | 1,822 | 4,502.76 | 0 | 39,486 |
| | *R* | 15,749 | 0.000917 | 0.024263 | –0.10038 | 0.101818 |

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| City | Variables | Obs. | Mean | Std.Dev. | Min. | Max. |
|---|---|---|---|---|---|---|
| **Fuzhou** | *comedy* | 726 | 831 | 3,799.482 | 0 | 60,087 |
| | *all* | 726 | 3,347 | 11,745.68 | 0 | 109,810 |
| | *R* | 17,676 | 0.001444 | 0.026863 | –0.10035 | 0.172965 |
| **Guangzhou** | *comedy* | 726 | 6,106 | 14,567.17 | 0 | 184,011 |
| | *all* | 726 | 27,560 | 43,212.54 | 0 | 348,204 |
| | *R* | 34,335 | 0.00142 | 0.026526 | –0.10082 | 1.377778 |
| **Hangzhou** | *comedy* | 726 | 5,971 | 11,079.73 | 0 | 113,996 |
| | *all* | 726 | 28,397 | 31,059.12 | 0 | 212,421 |
| | *R* | 36,302 | 0.001541 | 0.027342 | –0.10094 | 0.772592 |
| **Kunming** | *comedy* | 726 | 2,471 | 4,685.516 | 0 | 43,786 |
| | *all* | 726 | 11,506 | 31,059.12 | 0 | 81,324 |
| | *R* | 12,434 | 0.001068 | 0.024843 | –0.10022 | 0.440164 |
| **Nanjing** | *comedy* | 726 | 1,609 | 3,732.309 | 0 | 48,542 |
| | *all* | 726 | 7,341 | 10,680.29 | 0 | 77,184 |
| | *R* | 27,141 | 0.001239 | 0.025119 | –0.10023 | 0.439768 |
| **Ningbo** | *comedy* | 726 | 784 | 2,453.347 | 0 | 42,506 |
| | *all* | 726 | 3,108 | 5,716.906 | 0 | 57,268 |
| | *R* | 21,665 | 0.00108 | 0.02489 | –0.10069 | 0.101695 |
| **Shanghai** | *comedy* | 726 | 10,413 | 21,364.74 | 0 | 224,733 |
| | *all* | 726 | 48,207 | 60,536.39 | 0 | 406,153 |
| | *ret* | 110,015 | 0.001484 | 0.026744 | –0.25569 | 1.088571 |
| **Shenyang** | *comedy* | 726 | 612 | 2,076.655 | 0 | 37,740 |
| | *all* | 726 | 2,318 | 5,260.889 | 0 | 57,260 |
| | *R* | 10,767 | 0.001194 | 0.025736 | –0.10082 | 0.101493 |
| **Shenzhen** | *comedy* | 726 | 9,735 | 19,576.78 | 0 | 217,611 |
| | *all* | 726 | 43,294 | 59,441.78 | 0 | 382,297 |
| | *R* | 95004 | 0.001439 | 0.026678 | –0.10101 | 0.37064 |
| **Suzhou** | *comedy* | 726 | 2,215 | 6,953.42 | 0 | 124,056 |
| | *all* | 726 | 9,629 | 16,808.19 | 0 | 164,436 |
| | *R* | 18,170 | 0.001349 | 0.026542 | –0.10031 | 0.101083 |
| **Tianjin** | *comedy* | 726 | 4,257 | 9,758.568 | 0 | 156,195 |
| | *all* | 726 | 17,393 | 24,098.76 | 0 | 199,419 |
| | *R* | 21,108 | 0.001413 | 0.027465 | –0.10073 | 0.845 |
| **Wuhan** | *comedy* | 726 | 2,015 | 6,785.815 | 0 | 100,405 |
| | *all* | 726 | 8,636 | 18,813.84 | 0 | 161,946 |
| | *R* | 23,998 | 0.001166 | 0.024815 | –0.10055 | 0.101266 |
| **Xi'an** | *comedy* | 726 | 1,568 | 3,232.196 | 0 | 33,099 |
| | *all* | 726 | 6,591 | 8,518.248 | 0 | 66,826 |
| | *R* | 15,476 | 0.001297 | 0.026034 | –0.22644 | 0.666667 |
| **Zhengzhou** | *comedy* | 726 | 740 | 2,710.709 | 0 | 33,064 |
| | *all* | 726 | 2,320 | 6,209.512 | 0 | 44,862 |
| | *R* | 11,205 | 0.000759 | 0.023567 | –0.10017 | 0.100985 |

***Note***: This table presents statistics on the comedy moviegoers, general moviegoers, and stock returns of each city. A total of 921 trading days took place from March 19, 2012 to March 18, 2015. *comedy* denotes comedy moviegoers, *all* denotes general moviegoers, and *R* denotes stock returns.

**Table 2.** Descriptive statistics of main variables

| Variables | Obs. | Mean | Std.Dev. | Min. | Max. |
|---|---|---|---|---|---|
| ***R*** | 13,068 | 0.001295 | 0.014644 | –0.068707 | 0.053873 |
| ***comedy*** | 13,068 | 4,406.31 | 14,277.64 | 0 | 481,603 |
| ***all*** | 13,068 | 19,603.63 | 42,999.10 | 0 | 677,430 |
| ***Tax*** | 13,068 | 0.028926 | 0.167604 | 0 | 1 |
| ***SAD*** | 13,068 | –0.061960 | 0.063878 | –0.130785 | 0 |

***Note:*** A total of 13,068 (18×726) observations are obtained for the 18 cities. *comedy* denotes comedy moviegoers, *all* denotes general moviegoers, *R* denotes the equally weighted stock returns of listed companies at city c, *Tax* denotes the tax effect that is equal to 1 from the first trading day to the seventh trading day of each year and equal to 0 for the other trading days, and *SAD* denotes the seasonal affect disorder.



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Table 2 presents the descriptive statistics of the main variables of the 18 cities. A total of 13,068 observations are obtained from these cities (18×726). In Table 2, *all* represents the number of general moviegoers, *comedy* represents the number of comedy moviegoers, *Ret* denotes the equally weighted returns of the listed companies headquartered in each city, *Tax* denotes the tax effect, and *SAD* denotes the value of SAD. *Ret*, *Tax*, and *SAD* have average values of 0.001295, 0.028926, and –0.06196, respectively.

## 3. Empirical Test

To test whether the mood of local investors will affect the stock returns of locally headquartered listed companies, we perform an OLS regression on the number of moviegoers and the local stock returns of the 18 cities. We construct our basic model, model I, as follows:

$$R_{it} = \alpha_0 + \alpha_1 R_{i,t-1} + \alpha_2 D_{i,t-1} + \alpha_3 Tax_t + \alpha_4 SAD_t + \varepsilon_{i,t} \quad (1)$$

where $R_{it}$ is the stock return of listed company $i$ on day $t$, $Tax_t$ is the dummy variable of tax effect, and $D_{i,t-1}$ is the dummy variable of whether a comedy will be shown on day $t$-1 in the city where a company is headquartered. $D_{i,t-1}$ takes a value of 1 if a comedy movie is screened in the city, and takes a value of 0 otherwise.

Table 3 presents the regression results for the 18 cities.

**Table 3.** Impact of screening comedy movies on the stock returns in each city

| | $R_{i,t-1}$ | $D_{i,t-1}$ | $Tax_t$ | $SAD_t$ | *cons* | Wald chi2 | Obs |
|---|---|---|---|---|---|---|---|
| **Beijing** | 0.030521*** | –0.001628*** | –0.002101*** | –0.007450*** | 0.001951*** | 137.13*** | 84,248 |
| | (5.00) | (–7.49) | (–2.44) | (–6.78) | (9.68) | | |
| **Chengdu** | 0.029326*** | –0.000682** | –0.002845** | –0.008097*** | 0.001087*** | 19.86*** | 20,529 |
| | (2.48) | (–1.96) | (–2.35) | (–3.16) | (3.28) | | |
| **Chongqing** | 0.040847*** | –0.002495*** | –0.004973*** | –0.005980** | 0.002788*** | 126.29*** | 16,936 |
| | (3.39) | (–7.55) | (–5.73) | (–3.21) | (8.66) | | |
| **Dalian** | 0.034304** | 0.001401*** | –0.002312* | –0.004018* | –0.000076 | 35.16*** | 12,295 |
| | (2.28) | (5.12) | (–1.71) | (–1.86) | (–0.36) | | |
| **Fuzhou** | 0.027074*** | –0.000152 | –0.002595 | –0.003839 | 0.001018*** | 11.69*** | 13,787 |
| | (2.68) | (–0.39) | (–1.43) | (–1.33) | (2.94) | | |
| **Guangzhou** | 0.036823*** | –0.002095*** | –0.003833*** | –0.005137*** | 0.005137*** | 92.64*** | 26,809 |
| | (3.83) | (–6.47) | (–3.83) | (–2.85) | (8.75) | | |
| **Hangzhou** | 0.037318*** | –0.000952** | 0.000084 | –0.000538 | 0.001796*** | 28.50*** | 28,337 |
| | (4.38) | (–2.43) | (0.07) | (–0.28) | (5.50) | | |
| **Kunming** | 0.041997** | –0.002609*** | –0.005848*** | –0.009074** | 0.002621*** | 69.96*** | 9,694 |
| | (2.31) | (–4.98) | (–3.72) | (–2.80) | (6.26) | | |
| **Nanjing** | 0.018393* | –0.001246*** | –0.002225* | –0.001934 | 0.001940*** | 19.10*** | 21,185 |
| | (1.87) | (–3.22) | (–1.87) | (–0.97) | (5.60) | | |
| | $R_{i,t-1}$ | $D_{i,t-1}$ | $Tax_t$ | $SAD_t$ | *cons* | Wald chi2 | Obs |
| **Ningbo** | 0.014916 | –0.000881** | –0.004123*** | –0.005214* | 0.001291** | 38.49*** | 16,926 |
| | (1.55) | (–2.08) | (–4.28) | (–2.32) | (3.87) | | |
| **Shanghai** | 0.039839*** | –0.001364*** | –0.004423*** | –0.001687* | 0.002486*** | 240.04*** | 85,935 |
| | (6.03) | (–5.69) | (–8.74) | (–1.65) | (11.86) | | |
| **Shenzhen** | 0.029732*** | –0.001783*** | –0.000652 | –0.002863*** | 0.002564*** | 113.65*** | 74,110 |
| | (6.25) | (–7.53) | (–0.84) | (–2.69) | (12.33) | | |
| **Shenyang** | 0.030451** | –0.002334*** | –0.003420** | –0.00580* | 0.002611*** | 24.86*** | 8,405 |
| | (2.13) | (–3.79) | (–2.08) | (–1.95) | (5.89) | | |
| **Suzhou** | 0.019540* | –0.000612 | –0.000843 | –0.001210 | 0.001315*** | 7.97* | 14,180 |
| | (1.92) | (–1.31) | (–0.46) | (–0.39) | (3.68) | | |
| **Tianjin** | 0.023831** | –0.001496*** | –0.003959*** | –0.011159*** | 0.001887*** | 30.84*** | 16,474 |
| | (2.03) | (–3.78) | (–2.70) | (–4.23) | (5.90) | | |
| **Wuhan** | 0.008173 | –0.001382*** | –0.003611*** | –0.005872** | 0.001596*** | 37.57*** | 18,726 |
| | (0.93) | (–4.33) | (–3.04) | (–2.80) | (5.48) | | |
| **Xi'an** | 0.012050 | –0.002477*** | –0.001885 | –0.003793 | 0.002625*** | 33.27*** | 12,084 |
| | (1.03) | (–5.21) | (–1.01) | (–1.21) | (6.58) | | |
| **Zhengzhou** | 0.005558 | 0.001023** | –0.004824*** | –0.001934 | 0.000052 | 27.72*** | 8,751 |
| | (0.37) | (2.13) | (–3.74) | (–0.62) | (0.23) | | |

***Note:*** This table reports the regression results of screening comedy movies on returns. The explained variable is $R_{it}$, which denotes the stock return of company i on day t. $D_{i,t-1}$ is the dummy variable that equals to 1 if a comedy movie is shown on day t-1 in the city where company i is headquartered and equals to 0 otherwise. *Tax* denotes the effect that equals to 1 from the first trading day to the seventh trading day of each year and equals to 0 for the other trading days. *SAD* denotes the seasonal affect disorder and *Cons* is constant. The standard errors are clustered at the firm level and the z-statistics are reported in parentheses. *, **, and *** denote significance at the 1%, 5%, and 10% levels, respectively.

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The screening of comedy movies significantly affects the returns of listed companies in 13 cities, thereby suggesting that the mood of investors triggered by comedy movies has a significant impact on local stock returns. We also infer that local investors prefer to hold or purchase shares that are issued by local companies. Compared with investors outside the city, local investors are more familiar with local listed companies and have more channels from where they can obtain information. Most of these investors are local people with local feelings and are proud of their local language, social environment, and cultural environment. Therefore, they prefer to support local listed companies.

With the exception of Dalian and Zhengzhou, the positive moods triggered by watching comedy movies have a negative impact on the stock returns in the 16 other cities. The estimated coefficients for the comedy effect in 11 cities is significant at 1%, including Beijing (–0.001628), Chongqing (–0.002495), Guangzhou (–0.002095), Kunming (–0.002609), Nanjing (–0.001246), Shanghai (–0.001364), Shenzhen (–0.001783), Shenyang (–0.002334), Tianjin (–0.001496), Wuhan (–0.001382), and Xi'an (–0.002477). By contrast, the estimated coeffi-

**Table 4.** Impact of comedy moviegoers on the stock returns in each city

| | $R_{i,t-1}$ | $comedy_{i,t-1}$ | $all_{i,t-1}$ | $Tax_t$ | $SAD_t$ | *Cons* | Wald chi2 | Obs |
|---|---|---|---|---|---|---|---|---|
| **Beijing** | 0.024343*** | –5.88E–08*** | 7.88E–08*** | –0.002098*** | –0.004890*** | –0.002438*** | 719.96*** | 84,248 |
| | (3.96) | (–8.27) | (25.41) | (–2.49) | (–4.21) | (–18.11) | | |
| **Chengdu** | 0.021043* | –3.09E–07** | 5.33E–07*** | –0.002368* | –0.001707 | –0.001252*** | 175.74*** | 20,529 |
| | (1.77) | (–2.25) | (10.94) | (–1.96) | (–0.70) | (–4.59) | | |
| **Chongqing** | 0.032717*** | –1.44E–07*** | 2.01E–07*** | –0.004761*** | –0.004671** | –0.002443*** | 203.85*** | 16,936 |
| | (2.74) | (–4.02) | (12.40) | (–5.76) | (–2.37) | (–8.08) | | |
| **Dalian** | 0.032876** | –3.48E–06*** | 1.31E–06*** | –0.001250 | –0.004459** | –0.000067 | 120.50*** | 12,295 |
| | (2.20) | (–9.27) | (9.11) | (–0.93) | (–2.07) | (–0.33) | | |
| **Fuzhou** | 0.023168** | –7.87E–08 | 2.52E–07*** | –0.002221 | 0.001833 | 0.000780** | 98.40*** | 13,787 |
| | (2.30) | (–0.50) | (5.40) | (–1.24) | (0.60) | (3.51) | | |
| **Guangzhou** | 0.031780*** | 9.33E–09 | 9.95E–08*** | –0.004450*** | 0.000278 | –0.000205 | 246.96*** | 26,809 |
| | (3.32) | (0.34) | (10.83) | (–4.48) | (0.16) | (–1.13) | | |
| **Hangzhou** | 0.030830*** | –2.16E–07*** | 2.76E–07*** | 0.000423 | –0.003344* | –0.002849*** | 232.09*** | 28,337 |
| | (3.59) | (–6.01) | (13.78) | (0.34) | (–1.66) | (–10.45) | | |
| **Kunming** | 0.031935* | –3.98E–07** | 5.33E–07*** | –0.005901*** | –0.004925 | –0.002309*** | 88.57*** | 9,694 |
| | (1.80) | (–2.24) | (8.22) | (–3.69) | (–1.33) | (–6.37) | | |
| **Nanjing** | 0.011559 | –7.80E–07*** | 8.52E–07*** | –0.001704* | 0.001707 | –0.001303***31 | 318.39*** | 21,185 |
| | (1.19) | (–4.70) | (16.25) | (–1.46) | (0.79) | (–6.92) | | |
| | $R_{i,t-1}$ | $comedy_{i,t-1}$ | $all_{i,t-1}$ | $Tax_t$ | $SAD_t$ | *Cons* | Wald chi2 | Obs |
| **Ningbo** | 0.010815 | –9.34eE–07** | 1.18E–06*** | –0.004042*** | –0.002017 | –0.000603*** | 103.96*** | 16,926 |
| | (1.10) | (–2.99) | (9.45) | (–4.12) | (–0.90) | (–2.99) | | |
| **Shanghai** | 0.034620*** | –6.50E–08*** | 1.67E–07*** | –0.004057*** | –0.003323** | –0.002330*** | 933.20*** | 85,935 |
| | (5.23) | (–4.58) | (28.79) | (–8.25) | (–3.11) | (–17.25) | | |
| **Shenzhen** | 0.025957*** | –6.81E–08*** | 7.55E–08*** | –0.000899 | –0.001276 | –0.000287*** | 380.25*** | 74,110 |
| | (5.42) | (–4.27) | (16.45) | (–1.16) | (–1.15) | (–2.58) | | |
| **Shenyang** | 0.027340* | –1.85E–06*** | 1.10E–06*** | –0.003201* | –0.002595 | 0.000226 | 58.27*** | 8,405 |
| | (1.92) | (–3.64) | (5.33) | (–1.93) | (–0.81) | (0.83) | | |
| **Suzhou** | 0.015216 | –2.54E–07** | 3.69E–07*** | –0.000763 | 0.002372 | –0.000403 | 144.38*** | 14,180 |
| | (1.44) | (–2.55) | (8.32) | (–0.41) | (0.75) | (–1.91) | | |
| **Tianjin** | 0.019039* | –4.21E–07*** | 3.15E–07*** | –0.002650** | –0.008569** | –0.001299*** | 217.92*** | 16,474 |
| | (1.59) | (–7.73) | (13.09) | (–1.88) | (–2.84) | (–4.70) | | |
| **Wuhan** | 0.003518 | –2.52E–07** | 2.51E–07*** | –0.003601*** | –0.001188 | –0.000031 | 146.00*** | 18,726 |
| | (0.41) | (–4.13) | (10.99) | (–2.95) | (–0.61) | (–0.17) | | |
| **Xi'an** | 0.004840 | –1.12E–06*** | 1.10E–06*** | –0.001511 | –0.000914 | –0.002127*** | 193.77*** | 12,484 |
| | (0.43) | (–6.34) | (13.02) | (–0.82) | (–0.28) | (–7.34) | | |
| **Zhengzhou** | 0.003294 | –8.25E–07** | 5.67E–07*** | –0.004557*** | –0.000171 | 0.000142 | 66.61*** | 8,751 |
| | (0.22) | (–3.56) | (4.60) | (–3.54) | (–0.06) | (0.62) | | |

***Note:*** This table reports the regression results of comedy moviegoers on returns. The explained variable is $R_{it}$, which denotes the stock returns of company i on day t. $comedy_{i,t-1}$ denotes the number of comedy moviegoers on day t-1 at the headquartered city of company i, while $all_{i,t-1}$ denotes the number of general moviegoers on day t-1 at the headquartered city of company i. *Tax* denotes the tax effect that equals to 1 from the first trading day to the seventh trading day of each year and equals to 0 for the other trading days. *SAD* denotes the seasonal affect disorder and *Cons* is constant. The standard errors are clustered at the firm level and the z-statistics are reported in parentheses. *, **, and *** denote significance at the 1%, 5%, and 10% levels, respectively.



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cients of comedy in Chengdu, Hangzhou, and Ningbo is significant at 5%. These results indicate that the positive mood triggered by watching comedy movies will make investors more conservative and unwilling to take risks, thereby reducing the expected stock returns. To provide additional evidence, we propose model II as follows:

$$R_{i,t} = \beta_0 + \beta_1 R_{i,t-1} + \beta_2 comdy_{i,t-1} + \beta_3 all_{i,t-1} + \beta_4 Tax_t + \beta_5 SAD_t + \varepsilon_{i,t} \quad (2)$$

where $R_{i,t}$ is the stock return of company *i* on day *t*, $comdy_{i,t-1}$ is the number of comedy moviegoers on day *t*-1 in the city where company *i* is located, and $all_{i,t-1}$ is the number of general moviegoers on day *t*-1 in the same city.

Table 4 presents the regression results of model II. Except for Guangzhou and Fuzhou, the number of comedy moviegoers in the other cities has a significant negative impact on the stock returns of local companies. Especially, the coefficients of comedy moviegoers in 10 cities, including Beijing and Shanghai, are significant at 1%, while those in the other 6 cities, including Kunming and Ningbo, are significant at 5%. This result indicates that the positive moods of investors triggered by the local screening of comedy movies have a significantly negative impact on the stock returns of local companies. The regression results for 17 cities indicate that positive investor emotions will decrease stock returns in the future, which means that people tend not to take risks when they are in a positive mood. To maintain such mood, investors tend to avoid risky investments and adopt conservative investment strategies, thereby reducing stock returns. Table 4 shows that the magnitude for the coefficient of comedy moviegoers is statistically and economically significant. For example, the returns of listed companies and the number of comedy moviegoers in Beijing have standard deviations of 0.025823 and 40,031.62, respectively. Therefore, the one-standard-deviation change of comedy moviegoers is associated with a change of 40,031.62×(–5.88E-08)=0.002354 or approximately 9.12% of a standard deviation.

The positive impact of the number of general moviegoers in all cities on stock returns is significant at 1%. This finding is consistent with the fact that the influence of box office revenues on the stock market subsequently generates a positive economic effect. At the same time, as a control variable, the number of general moviegoers is positively related to stock returns, thereby suggesting the large magnitude of the direct negative effect of watching comedy movies on the stock market. In other words, the positive mood of investors triggered by watching comedy movies has a significant negative impact on stock returns, thereby supporting MMH. The regression results of models I and II also show that for most cities, tax effect has a significant negative impact on stock returns, that is, taxes will reduce the stock returns. SAD shows a significant effect in nine cities, including Beijing and Guangzhou, and has a negative impact on the expected stock returns for all cities. Therefore, SAD can motivate people to avoid investment risks, thereby generating a negative impact on the stock market. This finding is consistent with the conclusions of Kramer and Weber [37].

We then construct the equally weighted returns of listed companies at each city as the portfolio returns on each day, $R_{c,t}$, and obtain new data on returns. We perform a regression based on models I and II, and the results are presented in Table 5. Screening comedy movies shows a significant impact on equally weighted stock returns in either models I or II, thereby proving the existence of the local bias effect. The comedy dummy in model I has a coefficient of –0.000647 and is significant at 10%, while than in model II has a coefficient of –1.03e-07 and is significant at 1%. If there are 250 trading days in a year, the risk-free returns is 1.75%, and the transaction cost is about 1%, the annualized return based on short selling comedy movie strategy could be about 13.425% (0.0647%×250–1.75%–1%). Given that the positive mood of investors triggered by watching comedy movies will have a negative effect on the expected returns, the stock returns for the 18 selected cities are expected to be lower, thereby validating MMH.

**Table 5.** Impact of comedy dummy and comedy moviegoers on equally weighted returns

| Variables | *Model I* | *Model II* |
|---|---|---|
| | $R_{ct}$ | $R_{ct}$ |
| $R_{c,t-1}$ | 0.010981*** | 0.005501 |
| | (3.81) | (–0.56) |
| $D_{c,t-1}$ | –0.000647** | |
| | (–1.64) | |
| $comedy_{c,t-1}$ | | –1.03e–07*** |
| | | (–3.96) |
| $all_{c,t-1}$ | | 8.08e–08*** |
| | | (3.56) |
| *Tax* | –0.003084*** | –0.002977*** |
| | (–7.56) | (–7.32) |
| *SAD* | –0.005286** | –0.004866*** |
| | (–8.63) | (–6.90) |
| *Cons* | 0.001291*** | 0.000206 |
| | (3.47) | (–1.09) |
| **Wald chi2** | 109.63*** | 102.02*** |
| **Obs** | 10,242 | 10,242 |

***Notes:*** This table reports the regression results of comedy dummy and comedy moviegoers on returns. $R_{ct}$ denotes the equally weighted returns


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of listed companies at city c on day t. $D_{c,t-1}$ is the dummy variable that equals to 1 if any comedy movie is shown on day t-1 at city c and equals to 0 otherwise. $comedy_{c,t-1}$ denotes the number of comedy moviegoers on day t-1 at city c, while $all_{c,t-1}$ denotes the number of general moviegoers on day t-1 at city c. *Tax* denotes the tax effect that equals to 1 from the first trading day to the seventh trading day of each year and equals to 0 for the other trading days. *SAD* denotes the seasonal affect disorder and *Cons* is constant. The standard errors are clustered at the city level and the z-statistics are reported in parentheses. *, **, and *** denote significance at the 1%, 5%, and 10% levels, respectively.

## 4. Robustness Test

We use the proportion of comedy and general moviegoers, $Pro_{c,t}$, as the investor sentiment variable. Afterward, we replace $D_{i,t-1}$ with $Pro_{c,t}$. Given that each city screens a different comedy movie every day, $Pro_{c,t}$ may indicate how investors are influenced by the mood triggered by watching comedies. Although the 18 selected cities are all large cities in China, the number of permanent residents greatly differs across these cities. For example, the number of permanent residents in Beijing is about 12.40 million, which is almost twice larger than that of Kunming (6.55 million). Given that having more permanent residents corresponds to having more movie moviegoers, we must control the number of permanent residents in each city. Seeing that each city has a different number of permanent residents,

**Table 6.** Impact of ratio of comedy moviegoers to general moviegoers on returns

| | $R_{i,t-1}$ | $Pro_{c,t-1}$ | $Tax_t$ | $SAD_t$ | *cons* | Wald chi2 | Obs |
|---|---|---|---|---|---|---|---|
| **Beijing** | 0.032184* | –0.001419*** | –0.002132*** | –0.008424*** | 0.000755*** | 99.50*** | 83,653 |
| | (5.23) | ( –4.07) | ( –2.53 ) | ( –7.72) | (8.01) | | |
| **Chengdu** | 0.033216*** | –0.001642** | –0.002854** | –0.008078*** | 0.000933*** | 19.58*** | 19,897 |
| | (2.8) | (–2.02) | (–2.38) | (–3.00) | (4.28) | | |
| **Chongqing** | 0.043914*** | –0.001412* | –0.005149*** | –0.006702** | 0.000828** | 55.26*** | 16,819 |
| | (3.67) | (–1.81) | (–6.13) | (–3.66) | (3.86) | | |
| **Dalian** | 0.047851** | –0.010957*** | 0.009500*** | –.014013** | 0.002841*** | 106.28*** | 4,379 |
| | (2.02) | (–8.62) | (2.99) | (–3.31) | (6.97) | | |
| **Fuzhou** | 0.030185*** | 0.000128 | –0.002607 | –0.002018 | 0.001067*** | 13.19*** | 13,572 |
| | (2.90) | (0.20) | (–1.47) | (–0.69) | (4.41) | | |
| **Guangzhou** | 0.038294*** | 0.000937 | –0.004198*** | –0.005131** | 0.000735*** | 38.58*** | 26,622 |
| | (3.99) | (1.43) | (–4.28) | (–2.86) | (3.73) | | |
| **Hangzhou** | 0.039495*** | –0.001632*** | 0.000110 | –0.001443 | 0.001209*** | 31.28*** | 28,136 |
| | (4.61) | (–2.62) | (0.091) | (–0.74) | (6.61) | | |
| **Kunming** | 0.043943*** | –0.001570 | –0.006048*** | –0.010343*** | 0.000603 | 42.89*** | 9,626 |
| | (2.41) | (–1.45) | (–3.87) | (–3.02) | (2.61) | | |
| **Nanjing** | 0.019423** | –0.002031*** | –0.002112* | –0.002249 | 0.001253*** | 15.40*** | 21,034 |
| | (1.99) | (–3.31) | (–1.79) | (–1.11) | (6.36) | | |
| | $R_{i,t-1}$ | $Pro_{c,t-1}$ | $Tax_t$ | $SAD_t$ | *cons* | Wald chi2 | Obs |
| **Ningbo** | 0.014786 | –0.000448 | –0.004823*** | –0.010203*** | 0.000612** | 36.17*** | 15,737 |
| | (1.43) | (–0.75) | (–4.94) | (–4.43) | (3.07) | | |
| **Shanghai** | 0.041065*** | –0.000871** | –0.004509*** | –0.002727** | 0.001412*** | 151.76*** | 85,329 |
| | (6.21) | (–2.55) | (–9.12) | (–2.65) | (15.09) | | |
| **Shenzhen** | 0.031308*** | –0.000318 | –0.000917 | –0.003634** | 0.001037*** | 58.30*** | 73,590 |
| | (6.61) | (–0.81) | (–1.20) | (–3.40) | (9.54) | | |
| **Shenyang** | 0.033971** | –0.001147 | –0.003794** | –0.005892* | 0.000992*** | 11.03** | 8,333 |
| | (2.39) | (–1.07) | (–2.30) | (–1.94) | (4.34) | | |
| **Suzhou** | 0.020041** | 0.002317*** | –0.001313 | –0.000516 | 0.000396 | 11.38** | 13,930 |
| | (1.96) | (2.87) | (–0.72) | (–0.16) | (1.70) | | |
| **Tianjin** | 0.029906** | –0.004968*** | –0.002357* | –0.012708*** | 0.001512*** | 53.49*** | 16,357 |
| | (2.49) | (–6.77) | (–1.74) | (–4.47) | (6.61) | | |
| **Wuhan** | 0.008563 | –0.001969*** | –0.003678*** | –0.006745*** | 0.000794** | 21.91*** | 18,352 |
| | (1.00) | (–3.30) | (–3.14) | (–3.31) | (4.06) | | |
| **Xi'an** | 0.013152 | –0.003568*** | –0.002087 | –0.005364* | 0.001224*** | 75.31*** | 11,997 |
| | (1.13) | (–7.19) | (–1.13) | (–1.72) | (7.73) | | |
| **Zhengzhou** | 0.006031 | –0.002003 | –0.002439 | –0.008854 | 0.000804 | 10.208 | 4,152 |
| | (0.28) | (–2.05) | (–1.31) | (–2.31) | (2.29) | | |

***Note:*** This table reports the regression results of ratio of comedy moviegoers to general moviegoers on returns. $R_{it}$ denotes the returns of listed companies headquartered at city c on day t. $Pro_{c,t-1}$ denotes the ratio of comedy moviegoers to general moviegoers on day t-1 at city c. *Tax* denotes the tax effect that equals to 1 from the first trading day to the seventh trading day of each year and equals to 0 for the other trading days. *SAD* denotes the seasonal affect disorder and *Cons* is constant. The standard errors are clustered at the firm level and the z-statistics are reported in parentheses. *, **, and *** denote significance at the 1%, 5%, and 10% levels, respectively.



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**Table 7.** Impact of comedy moviegoers adjusted by residents on returns at the city level

| | $R_{i,t-1}$ | $Adjcomedy_{c,t-1}$ | $Adjall_{c,t-1}$ | $Tax_t$ | $SAD_t$ | *Cons* | Wald chi2 | Obs |
|---|---|---|---|---|---|---|---|---|
| **Beijing** | 0.024343*** | –0.728645*** | 0.977158*** | –0.002098*** | –0.004890*** | –0.002438*** | 719.96*** | 84,248 |
| | (3.96) | (–8.27) | (25.45) | (–2.41) | (–2.49) | (–18.11) | | |
| **Chengdu** | 0.021043* | –4.391616** | 7.588450*** | –0.002368** | –0.001707 | –0.001252*** | 175.74*** | 20,529 |
| | (1.77) | (–2.25) | (10.945) | (–1.96) | (–0.70) | (–4.59) | | |
| **Chongqing** | 0.032717*** | –1.150885*** | 1.614656*** | –0.004761*** | –0.004671 | –0.002443*** | 203.85*** | 16,936 |
| | (2.74) | (–4.02) | (12.40) | (–5.76) | (–2.37) | (–8.08) | | |
| **Dalian** | 0.032877*** | –24.07777*** | 9.069581*** | –0.00125 | –0.004459** | –0.000067 | 120.50*** | 12,295 |
| | (2.20) | (–9.27) | (9.11) | (–0.93) | (–2.07) | (–0.33) | | |
| **Fuzhou** | 0.023168** | –0.575265 | 1.840709*** | –0.002221 | 0.001833 | 0.00078*** | 98.40*** | 13,787 |
| | (2.30) | (–0.50) | (5.40) | (–1.24) | (0.60) | (3.51) | | |
| **Guangzhou** | 0.031780*** | 0.120111 | 1.281787 *** | –0.004450*** | 0.000278 | –0.000205 | 246.96*** | 26,809 |
| | (3.32) | (0.34) | 10.83) | (–4.48) | (0.16) | (–1.13) | | |
| **Hangzhou** | 0.030830*** | –1.903123*** | 2.434718 *** | 0.000423 | –0.003344* | –0.002849*** | 232.09*** | 28,337 |
| | (3.592) | (–6.01) | (13.78) | (0.34) | (–1.65) | (–10.45) | | |
| **Kunming** | 0.031935** | –2.605446** | 3.488486*** | –0.005901*** | –0.004925 | –0.002309*** | 88.57*** | 9,694 |
| | (1.80) | (–2.24) | (8.22) | (–3.69) | (–1.33) | (–6.37) | | |
| **Nanjing** | 0.011559 | –6.373794*** | 6.961905*** | –0.001704* | 0.001707 | –0.001303*** | 318.39*** | 21,185 |
| | (1.19) | (–4.70) | (16.25) | (–1.46) | (0.79) | (–6.92) | | |
| | $R_{i,t-1}$ | $Adjcomedy_{c,t-1}$ | $Adjall_{c,t-1}$ | $Tax_t$ | $SAD_t$ | *Cons* | Wald chi2 | Obs |
| **Ningbo** | 0.010815 | –7.143746** | 9.023136*** | –0.004042*** | –0.002017 | –0.000603** | 103.96*** | 16,926 |
| | (1.10) | (–2.99) | (9.45) | (–4.12) | (–0.90) | (–2.99) | | |
| **Shanghai** | 0.034620*** | –0.834630*** | 2.151769*** | –0.004057*** | –0.003323** | –0.00233*** | 933.20*** | 85,935 |
| | (5.23) | (–4.58) | (28.79 | (–8.25) | (–3.11) | (–17.25) | | |
| **Shenzhen** | 0.0259567*** | –0.720486*** | 0.798935*** | –0.000899 | –0.001276 | –0.000287* | 380.25*** | 74,110 |
| | (5.42) | (–4.27) | (16.45) | (–1.16) | (–1.15) | (–2.58) | | |
| **Shenyang** | 0.027340* | –15.20553*** | 9.05993*** | –0.003201* | –0.002595 | 0.000226 | 58.27*** | 8,405 |
| | (1.92) | (–3.64) | (5.33) | (–1.91) | (–0.81) | (0.83) | | |
| **Suzhou** | 0.015216 | –1.655415*** | 2.411306*** | –0.000763 | 0.002372 | –0.000403 | 144.38*** | 14,180 |
| | (1.44) | (–2.55) | (8.32) | (–0.41) | (0.75) | (–1.91) | | |
| **Tianjin** | 0.019039 | –4.970534*** | 3.713049 *** | –0.002650* | –0.008569** | –0.001299*** | 217.92*** | 16,474 |
| | (1.59) | (–7.73) | (13.09) | (–1.88) | (–2.84) | (–4.70) | | |
| **Wuhan** | 0.003518 | –2.565035*** | 2.557282*** | –0.003601*** | –0.001188 | –0.000031 | 146.00*** | 18,726 |
| | (0.41) | (–4.13) | (10.99) | (–2.95) | (–0.61) | (–0.17) | | |
| **Xi'an** | 0.00484 | –9.577601*** | 9.436853*** | –0.001511 | –0.000914 | –0.002127*** | 193.77*** | 12,484 |
| | (0.43) | (–6.34) | (13.02) | (–0.82) | (–0.28) | (–7.34) | | |
| **Zhengzhou** | 0.003294 | –7.512323** | 5.168224*** | –0.004557*** | –0.000171 | 0.000142 | 66.61*** | 8,751 |
| | (0.22) | (–3.56) | (4.60) | (–3.54) | (–0.06) | (0.62) | | |

***Note:*** This table reports the regression results of comedy moviegoers adjusted by residents on returns at the city level. *Rit* denotes the returns of listed companies headquartered at city c on day t. $Adjcomedy_{c,t-1}$ denotes the number of comedy moviegoers divided by the number of residents on day t-1 at city c, while $Adjall_{c,t-1}$ denotes the number of general moviegoers divided by the number of residents on day t-1 at city s. *Tax* denotes the tax effect that equals to 1 from the first trading day to the seventh trading day of each year and equals to 0 for the other trading days. *SAD* denotes the seasonal affect disorder and *Cons* is constant. The standard errors are clustered at the firm level and the z-statistics are reported in parentheses. *, **, and *** denote significance at the 1%, 5%, and 10% levels, respectively.

we divide the number of comedy and general moviegoers by the number of permanent residents to obtain two new investor mood variables, namely, $Adjcomedy_{c,t-1}$ and $Adjall_{c,t-1}$, which will allow us to control the impact of permanent residents on the mood of investors.

Tables 6 and 7 present the empirical results. Table 6 shows that after taking the proportion of comedy moviegoers as a proxy for investor sentiment, the proxy coefficients of 15 out of 18 cities are negative, while the coefficients of 10 cities have a significantly negative impact on local stock returns at the 10% level or above. Only one comedy coefficient in Table 7 is positive. Except for Fuzhou and Guangzhou, after considering population size, the investor sentiment of 88.9% of the cities has a significant negative impact on local stock returns, thereby supporting the existence of a local bias. Tables 6 and 7 prove the robustness of the above mentioned empirical results. The positive mood of investors triggered by watching comedy movies will reduce the expected stock returns, thereby suggesting that MMH has a certain interpretation ability in the Chinese stock market.

We use the proportion of comedy moviegoers to regress

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equally weighted stock returns, and the results are presented in Table 8. The proxies for the improved emotions of investors have a significant negative impact on the equally weighted stock returns of these cities, which is consistent with the results presented in Table 5.

**Table 8.** Impact of comedy dummy and comedy moviegoers on equally weighted returns based on resident population

| Variables | *Model I* | *Model II* |
|---|---|---|
| | $R_{ct}$ | $R_{ct}$ |
| $R_{c,t-1}$ | (0.018368) | 0.022428 |
| | (5.85) | –1.96 |
| $Pro_{c,t-1}$ | –0.001333** | |
| | (–2.81) | |
| $Adjcomedy_{c,t-1}$ | | –1.068202 *** |
| | | (–2.83) |
| $Adjall_{c,t-1}$ | | 1.060331*** |
| | | –8.86 |
| *Tax* | –0.002788*** | –0.002220*** |
| | (–5.91) | (–2.72) |
| *SAD* | –0.005845*** | –0.001269 |
| | (–7.27) | (–0.51) |
| *Cons* | 0.001083*** | –0.000078 |
| | (12.56) | (–0.36) |
| **F statistic** | 100.76*** | 22.18*** |
| **Obs** | 9,456 | 7,908 |

***Note:*** This table reports the regression results of comedy dummy and comedy moviegoers on equally weighted returns based on resident population. $R_{it}$ denotes the equally weighted returns of listed companies at city c on day t. $Pro_{c,t-1}$ is the proportion of comedy moviegoers to general moviegoers on day t-1 at city c. $Adjcomedy_{c,t-1}$ denotes the number of comedy moviegoers divided by the number of residents on day t-1 at city c, while $Adjall_{c,t-1}$ denotes the number of general moviegoers divided by the number of residents on day t-1 at city c. *Tax* denotes the tax effect that equals to 1 from the first trading day to the seventh trading day of each year and equals to 0 for the other trading days. *SAD* denotes the seasonal affect disorder and *Cons* is constant. The standard errors are clustered at the city level and the z-statistics are reported in parentheses. *, **, and *** denote significance at the 1%, 5%, and 10% levels, respectively.

## 5. Conclusions

Movie clips are often used in psychological experiments as visual materials to evoke emotions and to observe the subjective experience and physiological responses of the subjects. Given that these clips are often short and carefully selected, the reactions of subjects to these materials are usually expected. Unlike the conventional methods employed in experimental psychology, we adopt real-life data to examine the impact of positive emotions on the risk decision making of people. We study the relationship between the number of comedy moviegoers from 18 cities in China and the returns of locally headquartered listed companies.

The dummies of comedy movie screening and comedy moviegoers reveal that the stock returns of locally headquartered listed companies are reduced in the next day. Our study further confirms the impact of emotions on asset pricing. Although watching a movie is not directly linked to equity investments, the emotions triggered by these movies can affect the judgments and actions related to risk investment. These results also support MMH, that is, investors avoid risky investment behavior to maintain a positive emotional state. Our study also lends empirical support to the existence of home bias in a domestic capital market, that is, investors prefer to purchase stocks from local listed companies after controlling for the effects of cross-border investment restrictions, differences in risk-free rate of returns, and accounting systems.

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ARTICLE

# The Effectiveness of a Smoking Cessation Intervention Program Based upon a Process Model of Health Motivation

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ABSTRACT

The purpose of the present study was to investigate the effect of participation in a health motivation-based intervention program on college students' smoking behavior. One hundred and seventy smokers (mean age = 19.0 years, 151 males) from nine colleges and universities in Chengdu, China were randomly assigned to one of 5 groups that received between one and four sessions of the intervention, or no intervention. The intervention sessions included sequential activities based on the stages of the process model of health motivation. Each group completed questionnaires assessing health motivation and smoking behaviors at pre-test, immediately post-intervention, and at one month follow-up. Analyses indicated that the intervention program did improve participants' health motivation, and that was associated with reduced levels of smoking relative to baseline. The greater the number of sessions, the greater the reduction in smoking.

## 1. Introduction

Tobacco hazard is one of the most serious public health issues in the world, as exemplified by the prediction that by 2020 10 million people will die annually from smoking-related diseases, of whom 7 million will be smokers from developing countries [1]. This is greater than the number of predicted deaths resulting from malaria, maternal and major childhood conditions, and tuberculosis combined. However, while this hazard is preventable, the risk is unevenly distributed across the world, with research suggesting that about 30% of smokers in developed countries like the USA and Netherland can quit smoking successfully but less than 11% of smokers in China are able to do so [2-5].

Health motivation is a key factor influencing smoking cessation. For example, McCaul et al. analyzed 30 data sets from the past 50 years and found that the avoidance of acknowledgement of the negative influence of smoking on health is a decisive factor for individuals to not quit smoking [6]. On the other hand, motivation for health is the main reason and facilitator of individuals' successful attempts to cease smoking [7-10].

To date, various, health behavior theories including the Health Belief Model (HBM), Protection Motivation Theory (PMT), Theory of Planning Behavior (TPB), Health Action Process Approach (HAPA), Transtheoretical Model and Stage of Change (TTM) have underpinned research into smoking cessation. Xu has recently proposed an alternative

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model of health motivation that provides a new framework for research on smoking cessation [11]. According to the Process Model of Health Motivation, health motivation affects health behaviors such as smoking cessation within four sequential stages: generation of intention to cease smoking, establishment of a smoking cessation plan, adoption of smoking cessation action, and persistence in smoking cessation. The rationality of this approach is reflected in two aspects: first, the influence of health motivation on smoking cessation is divided into different stages according to the actual conditions; second, the model does not treat health motivation in isolation. Instead, the influence of internal and external factors on individuals' health motivation are fully considered. For example, although many people express a desire to quit smoking, they fail to establish a relevant smoking cessation plan or to adopt any smoking cessation actions that will help them to realize their health goals. Such individuals do have health motivation, but their health motivation is not strong enough to help them quit smoking successfully.

Since being put forward by Xu [11], the Process Model of Health Motivation has already been empirically studied in relation to healthy diet and physical exercise [12]. However, empirical evidence for the models application to smoking cessation is lacking. The present study therefore aims to develop an intervention program for smoking cessation based upon the health motivation process model and to examine its effectiveness.

## 2. Method

### 2.1 Participants

Two hundred participants were initially recruited from nine colleges and universities in Chengdu, China. They were randomly assigned to one of 5 groups (4 experimental groups and 1 control group), with 40 participants in each group. Due to multiple times of intervention, long duration, as well as frequent assessments, 30 participants withdrew. Therefore, 170 participants (Mean age =19.0, SD=) with effective data were retained, including 151 males and 19 females. Among them, 67 participants were completing majors in arts and sports, 47 participants were majoring in literature and history, and 56 participants were majoring in science and engineering. Fifty-eight were freshmen, 81 sophomores, 22 junior students, and 9 senior students.

### 2.2 Measures

#### 2.2.1 Scale of Health Motivation for Smoking Cessation

This scale is based on the Health Motivation Scale in Physical Activity [12] and contains 18 questions, and includes four dimensions: intention, planning, action, and persistence. Each dimension contains 4-6 questions. For example, one question in the dimension of "intention" is: "I intend to quit smoking, for it can reduce the harm to my health"; one question in the dimension of "planning" is: "I plan to reduce the daily cigarette consumption, for I hope to maintain health"; one question in the dimension of "action" is: "I have started to quit smoking"; one question in the dimension of "persistence" is: "I will stick to smoking cessation until I realize the goal of becoming healthy". The participants were requested to respond to each item, based on their own similarity, with response options ranging from "completely like me" (2) to "completely not like me" (-2). Six items are reverse scored. Higher total scores indicate higher health motivation. The internal consistency of the scale was high, with Cronbach's $\alpha = .87$. The internal consistency of the four subscales corresponding to the four dimensions mentioned above (intention, planning, action and persistence) were $\alpha = .79$, .68, .73 and .81 respectively.

#### 2.2.2 Questionnaire of Smoking Behaviors

This questionnaire was developed for this study to record demographic variables and smoking-related behavior. There are 9 questions in total, including: "How old were you when you began to smoke?" "How long have you been smoking?" and "How many cigarettes did you smoke every day in the past week?". In the present study, the number of cigarettes per day (CPD) before and after intervention was used to operationalise the dependent variable (smoking cessation behaviors).

#### 2.2.3 Feedback measures

An open-ended questionnaire asked participants what they liked about the intervention program and what they disliked about the intervention program. Another questionnaire assessed their perceived gains during the entire study on a 5-point scale (hardly, some, moderate, much, very much). An item example is "I am more confident to quit smoking."

### 2.3 Intervention Program

An intervention consisting of four levels was developed for the study (see Table 1). According to Xu's dynamic process theory of health motivation, the health motivation of smokers to quit includes four continuous dynamic stages: smokers generate the intention to quit smoking in order to obtain/maintain health; they make smoking cessation plans; they begin to implement smoking cessation action; and they stick to smoking cessation actions. Based upon this theory,



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four intervention activities related to the four sequential stages of health motivation were developed (see Table 2). These four activities were: Activity 1 (inspiring smokers to generate the intention to quit smoking in order to obtain better health by providing a PowerPoint-based lecture on "Tobacco and Health" and providing a "Tobacco and Health" Information Manual); Activity 2 (helping smokers to make a smoking cessation plan); Activity 3 (helping smokers to implement their smoking cessation action and overcome withdrawal symptoms; and Activity 4 (helping ex-smokers stick to smoking cessation to prevent relapse").

**Table 1.** Intervention Scheme

| Group | Intervention activities | Measurement arrangement |
|---|---|---|
| **Group A** | Activity 1 | Base line measurement→ 1 intervention activity→ Post-test 1→ Post-test 2 |
| **Group B** | Activity 1 and Activity 2 | Base line measurement→ 2 intervention activities→ Post-test 1→ Post-test 2 |
| **Group C** | Activity 1, Activity 2 and Activity 3 | Base line measurement→ 3 intervention activities→ Post-test 1→ Post-test 2 |
| **Group D** | Activity 1, Activity 2, Activity 3 and Activity 4 | Base line measurement→ 4 intervention activities→ Post-test 1→ Post-test 2 |
| **Group E** | None | Base line measurement→ Post-test 1→ Post-test 2 |

**Table 2.** Intervention Activities

| Activity | Theme | Intervention activities | Intervention approaches |
|---|---|---|---|
| **Activity 1** | Health knowledge education related to smoking | Publicize smoking hazards for college student smokers and inspire them to quit smoking for their physical health. | PPT & leaflet |
| **Activity 2** | Establish a reasonable smoking cessation plan | Help college student smokers identify smoking cessation methods and establish smoking cessation plans according to their smoking characteristics. Document plans by means of "Letter of Commitment to Smoking Cessation". | Group counseling |
| **Activity 3** | Implement smoking cessation action and overcome withdrawal symptoms | Provide techniques to college student smokers to overcome withdrawal symptoms and help them to appropriately adjust the planning of diet and sports (e.g. "smoking cessation exercise) during the withdrawal period to ease unfavorable symptoms. | Group counseling |
| **Activity 4** | Stick to smoking cessation and prevent relapse | Assist college student smokers to practice smoke-refusing skills in groups, help the relapsing participants to analyze the cause of relapse, and pass on some skills to them to stick to smoking cessation. | Group counseling |

The Information Manual for Activity 1 was derived from the Guide Book of Hospital Smoking Control jointly compiled by Chinese Association on Tobacco Control and the Chinese Hospital Association in 2009. It includes five parts, namely, "overview of prevalence of tobacco smoking", "injurious ingredients of tobacco smoking", "main diseases resulting from smoking", "harms of smoking to women and children" and "harms of second-hand tobacco smoking for health"[13]. The contents of "Tobacco and Health" lecture and PowerPoint presentation were consistent with the Information Manual. However, the presentation uses visual images with additional written elaboration.

## 2.4 Research Procedures

Smokers who were willing to participate in this study were recruited by way of advertisements announced by lecturers in class. Participants were then randomly allocated to one of the five groups. One Group (A) received the first activity in the intervention only, another (Group B) the first and second activities, another (Group C) received the first, second and third activities, and a fourth group (D) received each of the four activities (see Tables 1 and 2). The interval between activities for Groups B, C and D was one week. The control group (E) received no activities. The experimenter, one of the authors, delivered the intervention in small groups every second week with the assistance of two graduate students.

All participants completed measures three times: pre-intervention (T0), one week after completion of all intervention sessions (T1), and at follow-up (T2), one month after completion of post-test. After the intervention, participants in the intervention groups completed two feedback questionnaires.

## 2.5 Statistical Analyses

Primary analysis was directed at comparing smoking cessation behaviors of the control and treatment groups following intervention. Multilevel Poisson regression with random intercepts was used to compare the groups on the number of cigarettes smoked per day at time 2 and time 3, controlling for smoking behavior at baseline, as well as baseline and concurrent health motivation. Strength of association between the dependent variable and the predictors in the Poisson model was assessed with incremental risk ratios (IRR). IRR are exponential regression coefficients that represent percentage increase in the mean number of "events" (cigarettes smoked per day) for a one unit increase in the values of a predictor.

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## 3. Results

### 3.1 Health Motivation

For health motivation, test of homogeneity of variance showed that the variances across the five groups were equal, with F = .98, p = .419. Repeated measures MANOVA for the health motivation scores, revealed that there was no significant interaction between time and group, F(8, 258) = 1.40, p=.199, partial Eta squared = .41. However, analysis within and between groups indicated that at pre-test Group B had higher health motivation than all other groups except Group E (Group A, p =.026; Group C, p= .03; and Group D, p=.028). By post-test, Group B's health motivation, was significantly higher than that of all other groups (p=.017, .004, .027 and .034 for Groups A, C, D and E respectively). At followup, Group B's health motivation was higher than that of Group A (p = .001) (see Table 3).

**Table 3.** Means of Health Motivation scores by Group (Standard deviations in brackets)

| Group | *n* | Pre-test $T_0$ | One-way ANOVA for Pre-test To | Post-test $T_1$ | Follow-up $T_2$ | *Repeated measures ANOVA* | Tukey comparison |
|---|---|---|---|---|---|---|---|
| A | 37 | 7.21 (12.44) | $F = 1.94$, $p = .107$ | 10.82 (11.75) | 7.18 (12.22) | $F = 7.96$, $p < .001$ | 1<2*,2>3* |
| B | 35 | 13.71 (11.53) | | 17.71 (9.80) | 17.00 (7.78) | | 1<2*,1<3* |
| C | 33 | 7.04 (11.75) | | 9.61 (9.86) | 11.22 (10.39) | | 1<2*,1<3* |
| D | 31 | 6.35 (12.45) | | 11.83 (10.24) | 13.67 (11.13) | | 1<2*,1<3* |
| E | 34 | 9.32 (9.27) | | 10.84 (10.77) | 9.81 (10.74) | | |

***Note:*** *p<.05

Within groups, Group A experienced an increase in health motivation from pre-test to post-test (p= .023) but this increase was not maintained as health motivation decreased to baselines level by follow-up. Group B's health motivation increased between pre-test and post-test (p=.028) and this increase was maintained at follow-up. Group C's health motivation did not increase significantly between pre- and post-test, but by follow-up it had increased significantly compared to baseline (p=.05). Group D demonstrated a steady rise in health motivation from pre-test to post-test (p=.047) which was maintained at follow-up (p=.027). Finally, Group E exhibited no change in health motivation over the course of the study.

### 3.2 Smoking Behavior

Repeated measures MANOVA for smoking behaviour revealed that there was a significant interaction between time and group, F(8, 330) = 1.40, p<.001, partial Eta squared = .34. Analysis within and between groups indicated that at pre-test Group B smoked fewer cigarettes per day than all other groups except Group E (Group A, p =.026; Group C, p= .002; and Group D, p<.001). Group E smoked fewer cigarettes per day than Group D. By post-test, Group A was smoking fewer cigarettes than Groups C (p= .037) and E (p=.008). Group B's cigarette smoking was less than that of Groups C (p=.001), D (p=.003), and E (p<.001). At follow-up, Group A's smoking was more than Group B's (p=.004) and Group D's (p=.041). Group B was also smoking less than Group C (p=.021) and Group E (p<.001). Group D was smoking less than Group E (p= .001) (see Table 4).

**Table 4.** Means and Standard Deviation of Smoking Behavior

| Group(N) | Prestest | | Posttest1 | | Posttest2 | |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | Mean | SD |
| A(37) | 6.57 | 3.88 | 3.76 | 2.63 | 4.89 | 2.91 |
| B(35) | 4.49 | 4.39 | 2.80 | 2.67 | 2.86 | 2.78 |
| C(33) | 7.48 | 2.69 | 5.30 | 2.64 | 4.52 | 2.65 |
| D(31) | 7.97 | 4.62 | 5.06 | 3.71 | 3.42 | 2.62 |
| E(34) | 5.68 | 3.67 | 5.71 | 3.61 | 5.85 | 3.56 |

Within groups, Groups C and D experienced significant decreases in smoking between baseline and posttest and then between posttest and follow-up (Group D p<.001 in each case; Group C p<.001, and p=.001). Group A decreased smoking behaviour between baseline and posttest (p<.001) and maintained the improvement relative to baseline at followup (p<.001), despite an increase from posttest to follow-up (p<.001). Group B reduced smoking between baseline and posttest (p<.001), and maintained this reduction at follow-up. Group E exhibited no change in smoking over the course of the study.

An alternative way to consider the smoking rates reported by the five groups is to consider the "decrement rate", or the percentage reduction in smoking from pre-intervention smoking level. As shown in Table 5 and Figure 1, the decrement rates of cigarettes per day (CPD) of the groups from pretest to posttest were different, and the extent of change is ordered as follows: Group A>Group D>Group C>Group B>Group E. The CPD of Group A, Group B, Group C and Group D declined significantly over this time. From baseline to follow-up, the decrement rates of CPD of the 4 intervention groups also varied. The extent of change was ordered as follows: Group D>Group C>Group B>Group A>Group E. The CPD of Group C and Group D continued declining. However, the CPD of Group A and Group B rose again,



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with Group A having the lowest maintenance despite its relatively favorable initial intervention effect. The control group CPD remained basically unchanged over the three time points (see Figure 1).

**Table 5.** CPD Decrement Rate of Each Group

| Group | *n* | Pre-test ($T_0$) | Post-test ($T_1$) | | Follow-up ($T_2$) | |
|---|---|---|---|---|---|---|
| | | CPD (PCS) | CPD (PCS) | DCR (%) | CPD (PCS) | DCR (%) |
| **Group A** | 37 | 6.57±3.88 | 3.76±2.62 | 43.61 | 4.89±2.91 | 24.44 |
| **Group B** | 35 | 4.49±4.39 | 2.80±2.67 | 25.64 | 2.86±2.78 | 25.33 |
| **Group C** | 33 | 7.48±2.69 | 5.30±2.64 | 29.57 | 4.52±2.65 | 39.97 |
| **Group D** | 31 | 7.97±4.62 | 5.06±3.71 | 38.99 | 3.42±2.618 | 55.82 |
| **Group E** | 34 | 5.68±3.67 | 5.71±3.61 | -5.22 | 5.85±3.56 | -14.99 |

***Note:*** DCR= Decrement rate in cigarettes per day relative to $T_0$

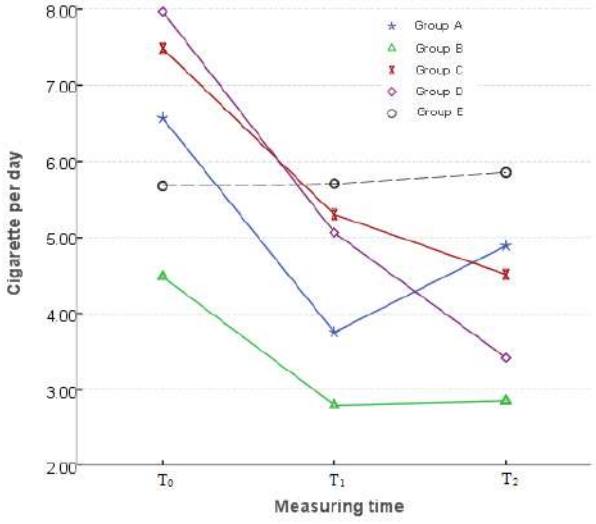


**Figure 1.** Mean CPD for Participants in Each Group in Three Measurements

Initial Poisson regression analysis comparing experimental groups on smoking behavior at baseline revealed significant differences between the groups in the number of cigarettes smoked (Wald chi-square(4)=18.95, p= .001). Groups 5 (M=4.5, 95% CI 3.5-5.8) and 2 (M= 4.5, 95% CI 3.3-6.2) reported the lowest number of cigarettes smoked, followed by group 1 (M=6.9, 95% CI 5.7-8.4), and groups 4 (M=7.4, 95% CI 5.6-9.6) and 3 (M=7.4, 95% CI 6.5-8.4).

Results of Poisson regression analysis comparing smoking cessation behaviors of the control and treatment groups following intervention showed that there was a significant main effect of treatment group (F(4,255)=13.4, p<.001), indicating that experimental groups differed significantly on the number of cigarettes smoked per day at post intervention, after controlling for the assessment time, time by group interaction, baseline smoking behavior, and baseline and concurrent health motivation. Compared with the control group, all intervention groups reported significantly lower number of cigarettes smoked per day at post intervention (p≤.025). The results were also generally supportive of the dose-response model of intervention, with greatest decrease in the number of cigarettes smoked per day in group 4 (IRR= 0.48, 95%CI 0.37-0.61) and lowest decrease in group 1 (IRR=0.85, 95%CI 0.73-0.99), although unexpectedly, the decrease in group 2 (IRR=0.68, 95% CI 0.59-0.78) was greater than that in group 3 (IRR=0.75, 95% CI 0.65-0.87). Follow up contrasts showed that amongst the groups that received intervention, there were significant differences between groups 1 and 4 (p=.003), 2 and 3 (p=.001), and 3 and 4 (p<.0001).

Baseline smoking was another significant predictor of the number of cigarettes smoked per day (IRR=1.25, 95%CI 1.23-1.27, p<.001). However, neither baseline (IRR=1.00, 95%CI 0.99-1.00, p=.358) nor concurrent health motivation (IRR=1.00, 95% CI 1.00-1.01, p=.219) was associated with the number of cigarettes smoked per day post intervention. On the other hand, while there were no significant differences in the number of cigarette smoked per day between the 2 follow up occasions (IRR=0.93, 95% CI 0.86-1.01, p=.079), there was a significant time by group interaction (F(4,255)=15.1, p<.001), indicating that the effect of group on the number of cigarettes smoked per day was different at first and second follow ups.

**Table 6.** Short-term Effect and Long-term Effect of Different Intervention Schemes

| | | *df* | *F* | *P* |
|---|---|---|---|---|
| **Within subject** | times of measuring | 2 | 163.78*** | <.001 |
| | times of measuring X groups | 8 | 21.80*** | <.001 |
| **Between subject** | groups | 4 | 3.37* | .011 |

Mean (with 95% confidence interval) number of cigarettes smoked per day for each study group at both follow up times are shown in Figure 2. Follow up contrasts comparing outcomes on treatment groups at each measurement occasion showed that after adjusting for baseline smoking behavior and baseline and concurrent health motivation, at time 2, experimental groups 1 (p<.001), 2 (p<.001), and 4 (p=.020) were smoking significantly fewer cigarettes per day compared with the control group. At time 2, there were also significant differences between groups 1 and 3 (p<.001), 1 and 4 (p=.026), and 3 and 2 (p<.001). At time 3, all 4 experiment groups were smoking significantly fewer cigarettes per day compared with the control group (p≤.035). There were also significant differences

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between groups 1 and 2 (p=.001), 1 and 4 (p<.001), 2 and 4 (p=.001), and 3 and 4 (p<.001). Within-group comparisons also showed that from time 2 to time 3, there was a significant increase in the number of cigarettes smoked per day in group 1 (p<.001) and a significant decrease in groups 3 (p=.001) and 4 (p<.001), after controlling for baseline smoking behavior, and baseline and concurrent health motivation (see Figure 2).

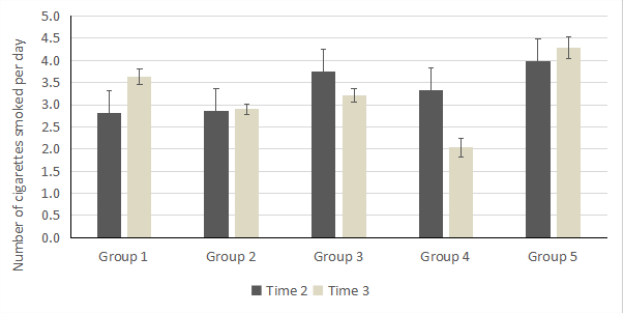


**Figure 2.** Mean (with 95% confidence interval) number of cigarettes smoked per day for each study group

### 3.3 Viewpoints of Members of Experimental Groups

The members of experimental groups made relatively positive comments in their general evaluation of the intervention. They reported that the activities included in the intervention were interesting, relaxing and also meaningful. Through the activities, they acquired more knowledge about smoking and smoking cessation, and came to understand their smoking characteristics and how to handle the withdrawal symptoms that occur with smoking cessation. It became easier for them to accept smoking cessation psychologically. On the downside, some participants reported that other members of their groups arrived late or would chat but refuse to speak when it was their turn to voice opinions and feelings, and that this influenced the group's progress.

Opinions of the 136 members of four experimental groups about the intervention activities are summarized in Table 7. From the table it can be seen that 89.60% of participants found the intervention to be "very helpful for me". They found the intervention activities for smoking cessation to be meaningful and to provide help to quit smoking. Participants agreed that the intervention had a positive influence on them, with 93.20% of them agreeing strongly with the statement that "I have a new understanding of cigarettes"; 72.80% of students with the statement that "I have a different attitude towards cigarettes", and 95.70% with the statement "I smoke less".

**Table 7.** Feedbacks of Members of Experimental Groups related to Group Activities (% of responses)

| Gains | hardly any | some | moderate | much good | very much |
|---|---|---|---|---|---|
| I am free to express my views in this group. | 0 | 0 | 0 | 15.40 | 84.60 |
| I have better understanding of my smoking characteristics. | 0 | 13.10 | 23.20 | 33.40 | 30.30 |
| I have acknowledged some problems existing in my smoking quitting process. | 0 | 0 | 25.10 | 26.70 | 48.20 |
| I know how to quit smoking more efficiently. | 7.30 | 18.50 | 32.90 | 29.60 | 11.70 |
| I know better how to refuse others' cigarettes. | 3.30 | 9.70 | 31.30 | 27.60 | 28.10 |
| I become more confident of quitting smoking. | 8.90 | 17.30 | 29.50 | 23.70 | 20.60 |
| I think I can establish a plan to quit smoking and strive for it. | 5.50 | 19.90 | 21.70 | 24.30 | 28.60 |
| I have learned how to adjust my unhealthy emotions and try to quit smoking. | 34.20 | 21.40 | 22.90 | 13.80 | 7.70 |
| I learn how to get rid of addiction to tobacco. | 12.80 | 33.60 | 25.30 | 17.20 | 11.10 |
| I think this group coaching is very meaningful for me. | 0 | 1.10 | 3.20 | 6.10 | 89.60 |
| I have a new understanding of cigarette. | 0 | 0 | 0.50 | 6.30 | 93.20 |
| I have a different attitude towards cigarette. | 2.30 | 4.10 | 7.20 | 13.60 | 72.80 |
| I smoke less. | 0 | 0 | 0.90 | 3.40 | 95.70 |
| I become healthier after stopping smoking. | 11.20 | 13.50 | 21.50 | 19.10 | 34.70 |

## 4. Discussion

The current study aimed to evaluate the effectiveness of a smoking cessation intervention that was based on the process model of health motivation. The intervention groups received activities related to the first, first and second, first, second and third, or all four stages of the process model of health motivation. The results indicated that except for Group 3 all intervention groups' motivation increased by the end of the intervention. This is to be expected since all groups participated in the first activity which was designed to increase motivation. This finding indicates that participants began to attach importance to the harm of smoking to health as a result of this part of intervention program. In contrast, the health motivation of the control group did not change.

It is notable that although the change in Group C's health motivation did not reach significance by post-test, realtive to baseline, by follow-up it did. Groups B maintained its increased health motivation, while Group D extended its improvement. These changes are not surprising since each of these groups received further activities relative to group A (no further activity). Therefore, staged and continuous intervention is superior to one-off or more



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limited intervention activities, and may be necessary to lead to and maintain quitting behavior. It is likely that the content of the later activities re-inforces and builds on the motivation that can be developed in the first activity. These results support the findings of Liu, et al. that the greater the dose of intervention, the better the intervention effect will be[14]. However, the difference between this research and research of Liu, et al. lies in the theoretical model on which the intervention program is based. Our program is designed in accordance with Xu's dynamic process model of health motivation but the Liu et al.'s lacks of strong theoretical base and the intervention implemented focused only on health knowledge.

The intervention also lead to a reduction in smoking behavior, to a degree that was dependent on the level of intervention. The groups that received the greater number of activities (sessions) demonstrated the greatest reduction in cigarettes per day, relative to baseline, both after the intervention and at follow-up. Their smoking behavior at follow up was still decreasing, but they had not stopped smoking. Notably, group A, which received the least intervention, demonstrated an increase in smoking between post-test and follow-up, although their smoking levels remained significantly lower than at baselines. This again suggest that the closer the participants are to receiving the complete program, addressing each stage of the process model of health promotion, the more likely they will be able to reduce their smoking behavior.

Finally, the participants reported that the intervention was a positive experience for them. They found the content meaningful, and the intervention activities for smoking cessation important. They also felt efficacious in regard to quitting smoking. More importantly, they gained a new understanding of cigarettes, and changed both their attitudes to cigarettes and smoking behaviors. Therefore, from the perspective of the participants, the intervention program implemented in this research was useful.

## 5. Conclusion and Limitations

Sample issues constitute one limitation of this study. Smokers from only nine colleges in Chengdu, in China were included in the sample. The final 170 participants included some "secondary technical school students" who were relatively young. Meanwhile, the distribution of participants in terms of age, grade, major and gender was limited. In addition, self-reporting of smoking behaviors and attitudes may have been unreliable. Some participants may have hidden their true smoking level. Therefore, in future research, other ways to record smoking may need to be considered. Finally, there are many factors influencing smoking cessation behaviors. In this research, due to a relatively long-time intervention for college student smokers, some influencing factors could not be controlled, (e.g., the influence of important others, other life events and activities that encourage smoking).

In conclusion, the intervention program was effective, which supported the dynamic process model of health motivation. In future, studies can be designed to further investigate the effectiveness of the program, as well as the process model of health motivation.

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REVIEW

# Facial Expression Recognition of Portuguese using American Data as a Reference

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ABSTRACT

It is unknown if the ability of Portuguese in the identification of NimStim data set, which was created in America to provide facial expressions that could be recognized by untrained people, is (or not) similar to the Americans. To test this hypothesis the performance of Portuguese in the recognition of Happiness, Surprise, Sadness, Fear, Disgust and Anger NimStim facial expressions was compared with the Americans, but no significant differences were found. In both populations the easiest emotion to identify was Happiness while Fear was the most difficult one. However, with exception for Surprise, Portuguese tend to show a lower accuracy rate for all the emotions studied. Results highlighted some cultural differences.

## 1. Introduction

Several studies have shown that the facial expression of basic emotions can be universally recognised [2,9] . Indeed, more than 30 studies have suggest this universality of recognition [11] and a meta-analysis of 168 datasets examining judgments of emotion in nonverbal stimuli (including facial expression) indicated universal emotion recognition above chance levels [5]. More than 75 studies have pointed basic facial expressions are produced when emotions are elicited spontaneously [14] and other research showed that the production of spontaneous facial expressions of emotion is not dependent on observational learning [10]. However, Elfenbein, Mandal, Ambady, Harizuka and Kumar (2004) highlighted that some studies above mentioned also prove for cultural differences, once American performed better than others using American stimuli. For example, using American emotional facial expressions, accuracy rates of 86% were described for participants of the United States[2], and 52% for members of the Borneo Sadong tribe [4]. In another study American participants correctly identified 83% of stimulus, European groups 75 to 83%, Japanese 65%, and Africans 50% [8]. In turn, Elfenbein and Ambady (2003) compared Chinese located in China and in the United States, Chinese Americans, and non-Asian Americans, Tibetans residing in China and Africans residing in the United States, and propose that these differences on accuracy rates could be explained by a intragroup advantage based in subtle differences in style across cultures, that improved with bigger contact [6]. However, that intragroup advantage has not been found in the studies of Matsumoto and Willingham (2009) us-

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ing photographs spontaneity and not posed.

Other studies have shown that there are some differences in the interpretation of facially expressed emotions in people from different cultures. For example, Shioiri, Someya, Helmeste and Tang (1999) found that, in spite of using Japanese stimulus, the young Japanese sample experienced difficulties in recognizing some emotional facial expressions and misunderstood others, when compared to previous studies using American subjects. A possible explanation could be the advanced by Yuki, Maddux, and Masuda (2007), who showed that when judging emotions Americans give primacy to mouth cues while Japanese tend to valorise eye cues.

The reasons for the disagreement in the findings could be related to differences in the methodology used, namely the previewing of slides, judgement context, presentation order, the use of posed expression and type of response format [1], as well as the own stimuli used. Indeed, one of the main problems in research on the identification of facial expressions is the difficulty in finding stimuli that accurately assess the emotions we want to evaluate and to have a large database of validated stimuli with different people expressing different emotions [19].

A broad set of face posed stimuli called NimStim was created in America to provide facial expressions that could be recognized by untrained people [18]. This set, which is available online and can be used by the scientific community around the world, has never been applied in Portugal. As such, it is unknown if the ability of Portuguese in the identification of NimStim facial expressions is (or not) similar to the Americans. To test this hypothesis we compare the performance of Portuguese in the recognition of NimStim facial expressions with data published in the literature for similar experiments performed with Americans.

## 2. Material and Methods

### 2.1 Participants

269 Portuguese citizens (109 males and 160 females) volunteers recruited by advertising with ages between 18 and 35 years old (Mean Age = 26.45 years old, Standard Deviation = 5.55), and different number of years of vertical schooling (Maximum = 19, Minimum = 3; Mean = 11.92, Standard Deviation = 2.98), were selected. These people were living either in urban centres or in the country.

### 2.2 Materials

A shortened version of the original NimStim study [18], comprising 515 photographs which achieved more than 50% of correct answers in the original study of 672 images used by Tottenham et al. (2009), was used. These pictures such as in the original study are of professional actors (14 men and 18 women), of various ethnic groups (10 African, 6 Asian, 25 European, 2 Latin-American), facially expressing the six basic emotions (happiness, disgust, fear, anger, sadness and surprise) and also calm and neutral faces. The colour photographs were mounted on a white background.

The selected set of photographs was beforehand shown to a heterogeneous group of 20 participants as a way of checking the clarity, meaning and accuracy of the words referring to the emotions that were chosen for the Portuguese answering system. The participants suggested some changes in the answering method and in the specification of some emotions. Thus, it was decided to name the emotions, instead of using the adjectives referring to those who feel them. Therefore, the Portuguese names given to the emotions were *tristeza* (sadness), *raiva* (anger), *medo* (fear), *felicidade* (happiness), *surpresa* (surprise), *nojo*(disgust), *neutro* (neutral), *calmo* (calm) and *outro* (other).

### 2.3 Procedure

The photographs were digitalized beforehand and randomised with the Software SuperLab, version 4.0, and showed to the participants one-by-one on a 15-inch computer screen, without a time limit and force-choice. However, to help focus attention and avoid other interferences, the participants were instructed to press the key of the corresponding emotion as fast as they could. Besides the six basic emotions, the participants had a key for "calm", another for "neutral" and also the option "other", totalizing nine possible answers. The photographs were presented continuously without any kind of feedback.

### 2.4 Statistical analysis

Data were analyzed utilizing the using Statistica (version 8) software on a PC computer and the interactive calculation tool for chi-square of Preacher (2001). All calculations were made using the Chi-square test. Statistical significance was considered at $p< 0.05$. All data are reported as mean (M) and standard deviation (SD).

## 3. Results

Because we were only interested in the basic emotions, we did not analyse the results for calm and neutral. The mean of the correct answers of the Portuguese for each basic emotion studied (happiness, surprise, sadness, fear,



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disgust, and anger) was calculated and compared with the accuracy rate of the Americans reported by Tottenham et al. (2009) The results are presented in Table 1.

**Table 1.** Accuracy rates of correct answers for happiness, surprise, sadness, fear, disgust, and anger in Portuguese and Americans using NimStim

| EMOTION | Portuguese M(SD) | American M(SD) | Chi-square | p value |
|---|---|---|---|---|
| HAPPINESS | 83.64 (16.91) | 92 (7.33) | 0.40 | 0.53 |
| SURPRISE | 78.91 (2.78) | 71 (11.50) | 0.42 | 0.52 |
| SADNESS | 59.08 (21.17) | 71.50 (18.50) | 1.18 | 0.28 |
| FEAR | 42.14 (19.23) | 60.00 (16.50) | 3.12 | 0.08 |
| DISGUST | 68.14 (28.71) | 89.50 (22) | 2.89 | 0.09 |
| ANGER | 73.73 (16.40) | 87 (24.50) | 1.10 | 0.30 |

***Note:*** M (SD), Mean ±Standard deviation

No significant differences were found on the accuracy rates for the basic emotions in Portuguese and Americans. In spite of this, Portuguese accuracy rates for Happiness, Sadness, Fear, Disgust, and Anger were lower than for Americans. In contrast, Portuguese accuracy rate for Surprise was higher than for Americans. Moreover, the Portuguese accuracy rate is above chance level for all emotions except for Fear.

The ability of recognition of the emotions by Portuguese followed the order: happiness >surprise > anger > disgust > sadness >fear while for Americans the order was happiness >disgust > anger > sadness > surprise > fear.

## 4. Discussion

In this study the performance of Portuguese in the recognition of NimStim photographs set were compared with data published in the literature for similar experiments performed with Americans to find out if the ability of Portuguese to identify facial expressions was (or not) similar to the Americans. To our knowledge it is also the first study using NimStim data set in a Portuguese sample.

The results showed that the performance of Portuguese is not significantly different from the Americans for all the emotions studied, which is consistent with previous findings concerning the universality of recognition of facially expressed emotions.

Also, Portuguese showed an accuracy rate above chance level for all emotions with exception for Fear. This finding leads us to the necessity of studying the psychometrics characteristics of NimStim applied to Portuguese population.

The lower result of Portuguese in the accuracy of Fear could also not be dissociated from the results obtained for Surprise (the only emotion in which Portuguese have an accuracy rate above the Americans). Thus, it seems that the facial expression of Surprise and Fear are object of confusion by the Portuguese sample and, also, that part of the photography's of Fear were confused with Surprise by Portuguese. This confusion between these two emotions were also found in previous studies [3,12].

It is common to Portuguese and Americans that Happiness is the easiest emotion to recognize while Fear is the more difficult one as found in previous research [15].

We also observed small differences between Portuguese and Americans in what concerns the recognition of facial expressions other than surprise. The ability of recognition of the emotions by Portuguese followed the order: surprise > anger > disgust > sadness while for Americans the order was disgust > anger > sadness > surprise. That may be explained taking by Portuguese been focused on facial different facial cues than Americans. This explanation is in accordance with the results found in previous study showing that both Americans and the Japanese tend to value different facial cues in the recognition of facial expressions [20].

It was also observed that Portuguese present an accuracy rate for all basic emotions lower than Americans with the only exception of Surprise above mentioned. This difference between both populations cannot be attributed to age or gender of the participants because, as described in the Material and Methods Section, the Portuguese sample was matched to the sample used by Tottenham et al. (2009) in what concerns age and gender. One putative explanation to the differences observed is the vertical schooling. Portuguese participants were a large and heterogeneous sample in regarding the vertical schooling, but there is not possible to know if our sample matched the American one for the factor vertical schooling.

Another possible explanation to justify the lower results of Portuguese as compared with Americans is related to the methodology used. In our study, the instruction to the participants to answer as quickly as possible was introduce while in the original study this statement did not exist. It is possible that the introduction of this statement in our study has influenced the recognition accuracy of the Portuguese participants.

### *Limitations and future researches*

A limitation of the present research is concerned with

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the lack of inclusion of the register of ethnicity of the participants. As the Portuguese sample included different ethnicity, the introduction of the register of ethnicity would allow us to analyse the influence of the ethnicity of stimulus on the recognition of facial expressions. This variable will be included in future research.

In future studies it would also be useful to investigate if the introduction of the instruction to participants to response as faster as they could is responsible or not for downward the accuracy. Moreover, it would also be interesting to compare the Portuguese and Americans abilities to recognise basic emotions facially expressed using Portuguese stimulus or a mixed database of Portuguese and American stimulus and also using spontaneously (and not posed) images of Americans.

## 5. Conclusion

The ability of the Portuguese to identify basic expressions using NimStim data set was similar to the Americans one. In both samples, Happiness was the easiest emotion recognized and Fear the most difficult. The results also highlighted cultural differences and suggested the necessity of studying the psychometric characteristic of Nimstim when applied in Portuguese.

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# Author Guidelines

This document provides some guidelines to authors for submission in order to work towards a seamless submission process. While complete adherence to the following guidelines is not enforced, authors should note that following through with the guidelines will be helpful in expediting the copyediting and proofreading processes, and allow for improved readability during the review process.

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- Required Documents

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All articles should include a cover letter as a separate document.

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- A brief description of the novelty and importance of the findings detailed in the paper

Declaration

v Conflict of Interest

Examples of conflicts of interest include (but are not limited to):

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This section confirms that written consent was obtained from all participants prior to the study.

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Authors should also include 5-8 keywords after the abstract, separated by a semi-colon, avoiding the words already used in the title of the article.

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In this section, the methods used to obtain the results in the paper should be clearly elucidated. This allows readers to be able to replicate the study in the future. Authors should ensure that any references made to other research or experiments should be clearly cited.

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Graphs, figures and tables should be labelled closely below it and aligned to the center. Each data presentation type should be labelled as Graph, Figure, or Table, and its sequence should be in running order, separate from each other.

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