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Resúmenes de revistas

Mayo - junio 2020

Junta de Andalucía
Consejería de Economía, Conocimiento, Empresas y Universidad
INSTITUTO DE ESTADÍSTICA Y CARTOGRAFÍA DE ANDALUCÍA

PRESENTACIÓN

El presente boletín de resúmenes tiene una periodicidad bimestral y con él la Biblioteca del Instituto de Estadística y Cartografía de Andalucía pretende dar a conocer a los usuarios de una forma detallada el contenido de las revistas especializadas que entran en su colección. Se trata de un complemento al boletín de novedades de publicaciones seriadas ya que en él se incluyen los resúmenes de cada uno de los artículos que aparecen publicados en los diferentes números de las revistas en el idioma original de las mismas.

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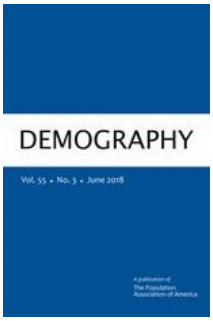


Demography, ISSN 0070-3370
Volume 57, number 1 (february 2020)

Abstract
We study the effects of the size of older cohorts on labor force participation and wages of older workers in the United States. We use panel data on states, treating the age structure of the population as endogenous, owing to migration. When older cohorts (50–59 or 60–69) are large relative to a young cohort (aged 16–24), the evidence fits the relative supply hypothesis. However, when older cohorts are large relative to 25- to 49-year-olds, the evidence points to a relative demand shift. Thus, we need a more nuanced view than simply whether the older cohort is large relative to the population: the cohort that they are large *relative to* matters.

Abstract
In this article, we consider how individuals' long-term employment trajectories relate to wage inequality and the gender wage gap in the United States. Using more than 30 years of data from the National Longitudinal Survey of Youth 1979 sample, we identify six employment trajectories for individuals from ages 22 to 50. We find that women across racial/ethnic groups and Black men are more likely than White and Hispanic men to have nonsteady employment trajectories and lower levels of employment throughout their lives, and individuals who have experienced poverty also have heightened risks of intermittent employment. We then assess how trajectories are associated with wages later in careers, at ages 45–50. We find significant variation in wages across work trajectories, with steady high employment leading to the highest wages. This wage variation is primarily explained by work characteristics rather than family characteristics. Finally, we examine gender variation in within-trajectory wages. We find that the gender wage gap is largest in the steady high employment trajectory and is reduced among trajectories with longer durations of nonemployment. Thus, although women are relatively more concentrated in nonsteady trajectories than are men, men who do follow nonsteady wage trajectories incur smaller wage premiums than men in steady high employment pathways, on average. These findings demonstrate that long-term employment paths are important predictors of economic and gender wage inequality.

Abstract
As many developed countries enact policies that allow children to begin universal childcare earlier, understanding how starting universal childcare earlier affects children's cognitive and noncognitive skills is an important policy question. We provide comprehensive evidence on the multidimensional short- and longer-run effects of starting universal childcare earlier using a fuzzy discontinuity in the age at starting childcare in Germany. Combining rich survey and administrative data, we follow one cohort from age 6 to 15 and examine standardized cognitive test scores,

noncognitive skill measures, and school track choice in a unified framework. Children who start universal childcare four months earlier around age 3 do not perform differently in terms of standardized cognitive test scores, measures of noncognitive skills, school track choice, or school entrance examinations. We also find no evidence of skill improvements for children with low socioeconomic status, although we provide suggestive evidence that they may benefit from high-quality care. Our estimates refer to children who start childcare before they become legally entitled, for whom the literature would predict low gains to starting childcare earlier. We provide further evidence on this relationship between parental resistance to and children's potential gains from childcare. Simply allowing children to start universal childcare earlier is hence not sufficient to improve children's skill development, particularly for children with low socioeconomic status.

Worth the Weight? Recent Trends in Obstetric Practices, Gestational Age, and Birth Weight in the United States P. 99-121

Andrea M. Tilstra, Ryan K. Masters

Abstract

Birth weight in the United States declined substantially during the 1990s and 2000s. We suggest that the declines were likely due to shifts in gestational age resulting from changes in obstetric practices. Using restricted National Vital Statistics System data linked birth/infant death data for 1990–2013, we analyze trends in obstetric practices, gestational age distributions, and birth weights among first-birth singletons born to U.S. non-Hispanic White, non-Hispanic Black, and Latina women. We use life table techniques to analyze the joint probabilities of gestational age-specific birth and gestational age-specific obstetric intervention (i.e., induced cesarean delivery, induced vaginal delivery, not-induced cesarean delivery, and not-induced vaginal delivery) to fully document trends in obstetric practices by gestational age. We use simulation techniques to estimate counterfactual changes in birth weight distributions if obstetric practices did not change between 1990 and 2013. Results show that between 1990 and 2013, the likelihood of induced labors and cesarean deliveries increased at all gestational ages, and the gestational age distribution of U.S. births significantly shifted. Births became much less likely to occur beyond gestational week 40 and much more likely to occur during weeks 37–39. Overall, nearly 18% of births from not-induced labor and vaginal delivery at later gestational ages were replaced with births occurring at earlier gestational ages from obstetric interventions. Results suggest that if rates of obstetric practices had not changed between 1990 and 2013, then the average U.S. birth weight would have increased over this time. Findings strongly indicate that recent declines in U.S. birth weight were due to increases in induced labor and cesarean delivery at select gestational ages.

Crime and Inequality in Academic Achievement Across School Districts in the United States P. 123-145

Gerard Torrats-Espinosa

Abstract

This study investigates the effect of violent crime on school district–level achievement in English language arts (ELA) and mathematics. The research design exploits variation in achievement and violent crime across 813 school districts in the United States and seven birth cohorts of children born between 1996 and 2002. The identification strategy leverages exogenous shocks to crime rates arising from the availability of federal funds to hire police officers in the local police departments where the school districts operate. Results show that children who entered the school system when the violent crime rate in their school districts was lower score higher in ELA by the end of eighth grade, relative to children attending schools in the same district but who entered the school system when the violent crime rate was higher. A 10% decline in the violent crime rate experienced at ages 0–6 raises eighth-grade ELA achievement in the district by 0.03 standard deviations. Models that estimate effects by race and gender show larger impacts among Black children and boys. The district-wide effect on mathematics achievement is smaller and statistically nonsignificant. These findings extend our understanding of the geography of educational opportunity in the United States and reinforce the idea that understanding inequalities in academic achievement requires evidence on what happens inside as well as outside schools.

Abstract
In this study, we provide demographic insight into the still relatively new family form of same-sex marriage. We focus on period trends in same-sex marriage formation and divorce during 1995–2012 in Sweden and the role of childbearing in same-sex unions. The period begins with the introduction of registered partnership for same-sex couples and also covers the introduction of formal same-sex marriage in 2009. We use register data for the complete population of Sweden to contrast patterns in male and female same-sex marriage formation and divorce. We show that female same-sex union formation increased rapidly over the period, while trends for male same-sex unions increased less. The introduction of same-sex marriage legislation in 2009 appears to have had little effect on the pace of formation of same-sex unions. In contrast, legal changes supporting parental rights in same-sex unions may have fueled the formation of female same-sex marriages as well as parenthood in such unions. Further, we show that divorce risks in the marital unions of two women are much higher than in other types of marriages. We find some convergence of divorce risks across union types at the end of our study period: male same-sex unions have the same divorce risk levels as opposite-sex marriages, and the elevated risks of divorce in female same-sex unions appear to have stabilized at somewhat lower levels than those observed in the late 1990s.

Abstract
Explanations for the substantial decline in rates of marriage in East Asian countries often emphasize the role of rapid educational expansion for women in reducing the desirability of marriages characterized by a strong gender-based division of labor. Focusing on South Korea, we consider a very different scenario in which changing educational composition of the marriage market reduces the demographic feasibility of such marriages. Analyses of 1% microsamples of the 1990 and 2010 Korean censuses show that changes in the availability of potential spouses accounted for part of the decline in marriage rates over a period of 20 years (1985–1989 to 2005–2009) for highly educated women and less-educated men. We also show that growth in international marriages played a role in preventing an even more dramatic decline in marriage among low-educated men. These findings support the general relevance of marriage market mismatches in gender-inegalitarian societies and highlight the declining feasibility of marriage for low-educated men in such contexts. Findings also hint at important implications for inequality in a society such as Korea, where marriage remains a symbol of social success and is closely related to women's economic well-being and men's health and subjective well-being.

Abstract
Unique longitudinal measures from Nepal allow us to link both mothers' and fathers' reports of their marital relationships with a subsequent long-term record of their children's behaviors. We focus on children's educational attainment and marriage timing because these two dimensions of the transition to adulthood have wide-ranging, long-lasting consequences. We find that children whose parents report strong marital affection and less spousal conflict attain higher levels of education and marry later than children whose parents do not. Furthermore, these findings are independent of each other and of multiple factors known to influence children's educational attainment and marriage timing. These intriguing results support theories pointing toward the long-term intergenerational consequences of variations in multiple dimensions of parents' marriages.

Abstract

The primary fertility index for a population, the total fertility rate (TFR), cannot be calculated for many areas and periods because it requires disaggregation of births by mother's age. Here we discuss a flexible framework for estimating TFR using inputs as minimal as a population pyramid. We develop five variants, each with increasing complexity and data requirements. We test accuracy across a diverse set of data sources that comprise more than 2,400 fertility schedules with known TFR values, including the Human Fertility Database, Demographic and Health Surveys, U.S. counties, and nonhuman species. We show that even the simplest and least accurate variant has a median error of only 0.09 births per woman over 2,400 fertility schedules, suggesting accurate TFR estimation over a wide range of demographic conditions. We anticipate that this framework will extend fertility analysis to new subpopulations, periods, geographies, and even species. To demonstrate the framework's utility in new applications, we produce subnational estimates of African fertility levels, reconstruct historical European TFRs for periods up to 150 years before the collection of detailed birth records, and estimate TFR for the United States conditional on race and household income.

Family, Firms, and Fertility: A Study of Social Interaction Effects P. 243–266

Zafer Buyukkececi, Thomas Leopold, Henriette Engelhardt

Abstract

Research has indicated that fertility spreads through social networks and attributed this phenomenon to social interaction effects. It remains unclear, however, whether the findings of previous studies reflect the direct influence of network partners or contextual and selection factors, such as shared environment and common background characteristics. The present study uses instrumental variables to improve the identification of social interaction effects on fertility. Using data from the System of social statistical data sets (SSD) of Statistics Netherlands, we identify two networks—the network of colleagues at the workplace and the network of siblings in the family—to examine the influence of network partners on individual fertility decisions. Discrete-time event-history models with random effects provide evidence for social interaction effects, showing that colleagues' and siblings' fertility have direct consequences for an individual's fertility. Moreover, colleague effects are concentrated in female-female interactions, and women are more strongly influenced by their siblings, regardless of siblings' gender. These results are the first to demonstrate spillover effects across network boundaries, suggesting that fertility effects accumulate through social ties not only within but also across different domains of interaction.

Pathways to Low Fertility: 50 Years of Limitation, Curtailment, and Postponement of Childbearing P. 267–296

Ian M. Timæus, Tom A. Moultrie

Abstract

This study applies survival analysis to the birth histories from 317 national surveys to model pathways to low fertility in 83 less-developed countries between 1965 and 2014. It presents period measures of parity progression, the length of birth intervals and total fertility that have been standardized fully for age, parity, and interval duration. It also examines parity-specific trends in the proportion of women who want no more children. Outside sub-Saharan Africa, fertility transition was dominated by parity-specific family size limitation. As the transition progressed, women also began to postpone their next birth for lengthy periods in many countries. During the first half of the fertility transition in much of sub-Saharan Africa and in some other countries, however, women stopped childbearing without targeting particular family sizes. Moreover, birth intervals in sub-Saharan Africa have been lengthening since the onset of the transition. Birth control is not restricted to a dichotomy between limitation and spacing. Other reasons for curtailing childbearing and postponing having another birth also shape countries' pathways through fertility transition.

Immigrant Fertility in Comparative Perspective: South Africa and the United States P. 297–322

Guadalupe Aguilera, Kim Korinek

Abstract

Because immigrant fertility is situated within two societies, the resultant childbearing patterns reflect a culmination of selectivity into migration alongside blended experiences of origin-destination contexts around fertility norms. We analyze the ways that national origin shapes patterns of childbearing within fertility covariates. We use data from Statistics South Africa and the United States Census Bureau harmonized in the Integrated Public Use Microdata Series, International for a disaggregated analysis of the odds of a birth in the past year among the three most prominent immigrant groups compared with native-born women in each receiving country. Interacted logistic regression analyses and margins results demonstrate significant nativity-based differences in the odds of childbearing across age, previous childbearing, and marital status, but not across educational attainment. We attribute variation in the covariates of fertility across nativities to demographic composition and the contexts of migration unique to each group.

Abstract

In this article, we conduct a comprehensive analysis of the effect of parental involvement (PI) laws on the incidence of abortions to minors in the United States. We contribute to the extant literature in several ways. First, we explore differences in estimates of the effect of PI laws across time that may result from changes in contraception, the composition of pregnant minors, abortion access in nearby states, and differences in how these laws are enforced. We find that PI laws enacted before the mid-1990s are associated with a 15% to 20% reduction in abortions to minors, but PI laws enacted after this time are not associated with declines in abortions to minors. Second, we assess the role of out-of-state travel by minors and find that it is not a significant factor moderating the effect of PI laws. Third, we use a synthetic control approach to explore state-level heterogeneity in the effect of PI laws and find large differences in the effect of PI laws on abortions to minors by state that appear unrelated to the type of PI law or whether contiguous states have enacted PI laws. Finally, we show that estimates of the effect of PI laws using data from either the Centers for Disease Control or the Guttmacher Institute do not differ qualitatively once differences in the states and years available across these data are harmonized.

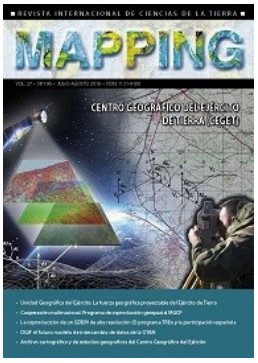
Abstract

In high-mortality contexts, research examining the effects of child mortality has focused almost exclusively on couples' fertility responses while overlooking other potential family consequences. Using nationally representative survey data from 13 West and Central African countries, we estimate multilevel discrete-time hazard models to determine how women's risk of intimate partner violence (IPV) varies with the death of children. We assess heterogeneity in this association across two surrounding circumstances: children's age at death and regional prevalence of child bereavement. Findings indicate that the risk of IPV initiation rises with the death of children under age 5—for whom women are most intensely responsible—but not with the death of older children. The effect of young child bereavement is most pronounced in regions where it is least prevalent among mothers—a finding not explained by concomitant regional variation in gender inequality, family norms, and infrastructural development. These findings highlight the importance of child mortality for family outcomes beyond fertility in the African context and demonstrate the prominent role of the broader mortality context in shaping these implications.

Abstract

Although paid work is a well-established predictor of health, several gaps in our knowledge about the relationship between adult work patterns and later health and mortality remain, including whether these benefits persist over long periods and whether they are dependent on subjective experiences with work. We draw on more than three decades of

data from the National Longitudinal Survey of Mature Women to assess how labor force participation over a period of 20 years during midlife is related to mental and physical health and mortality over the following 16–25 years. We find that consistent work earlier in life continues to predict improved health and longevity over many years as women enter late life, and this relationship does not differ between women with positive and those with negative subjective work experiences. These findings add to knowledge about how key adult social experiences are related to health as individuals enter later life.



Mapping: revista internacional de Ciencias de la Tierra, ISSN 1131-9100
Volumen 28, número 198 (noviembre – diciembre 2019)

SICA - El sistema de información de carreteras de Andalucía. Instrumento de apoyo a la toma de decisiones, a la explotación del dominio público viario y a la información a los usuarios P. 8-13

Moisés Barea Solís, Álvaro Arroyo Díaz

Resumen

La entrada en vigor de la Ley 8/2001, de 12 de julio, de Carreteras de Andalucía, dota a la Comunidad Autónoma de Andalucía de un marco legislativo y normativo propio para el ejercicio de su competencia exclusiva en materia de carreteras, y establece en su artículo 52 la obligatoriedad de la Administración andaluza de contar con un Sistema de Información de Carreteras. Este sistema, el SICA, integra todos los datos básicos de la Red de Carreteras de Andalucía necesarios para el desarrollo y aplicación de la política sectorial en esta materia, y requiere la actualización y mantenimiento continuos y sistematizada de su información debido a la dinamicidad de la Red de Carreteras de Andalucía. Desde 2017, el SICA está abordando un ambicioso proceso de optimización, con una clara vocación de servicio transversal dentro de la Junta de Andalucía y de innovación tecnológica, tanto en la captura de las características físicas y geométricas del dominio público viario, como en la aplicaciones y sistemas que sirven de apoyo a la toma de decisiones, a la explotación de ese dominio público viario y a la información a los usuarios. Que convierte al SICA en el más ambicioso de España en esta materia.

El papel de IDEAMB en la plataforma smart city del Área Metropolitana de Barcelona P. 12-17

Juan Carlos González González

Resumen

El Área Metropolitana de Barcelona (AMB) ha venido desarrollando durante el último lustro una plataforma de smart city denominada SmartAMB con la que pretende dar respuesta a los retos de mayor eficiencia en la gestión de sus activos competenciales, siendo este un claro exponente de escenario big data en el que la variable geográfica cobra un papel preponderante. En este contexto y teniendo en cuenta la dimensión de AMB como organización, resulta de vital importancia disponer de una infraestructura de datos espaciales (IDE) que facilite la catalogación, descubrimiento y utilización de todos los conjuntos de información georreferenciados, los cuales podrán ser integrados con otras fuentes de datos para desarrollar los flujos analíticos que se correspondan para facilitar la toma de decisiones.

Información Geoespacial Aeronáutica P. 18–25

Miguel Ángel Zazo González

Resumen

El transporte aéreo de pasajeros o mercancías es un sector en continuo crecimiento y fundamental en la economía. Europa concentra más de la cuarta parte del tráfico mundial de pasajeros. Para la gestión del transporte aéreo se requiere de una información geoespacial precisa y accesible. La información geoespacial aeronáutica es un elemento

esencial en la planificación y seguridad de la navegación aérea. La gestión y distribución de la información aérea es responsabilidad de los Estados. Depende de la normativa internacional publicada por organismos como OACI. La información geoespacial para la navegación no es estática. Puede variar debido a factores como la meteorología, la densidad del tráfico aéreo, la categoría de la aeronave, características del aeropuerto, las restricciones de espacios aéreos, la orografía, los
obstáculos del terreno, etc. Lo datos aeronáuticos están presentes en todas las fases del vuelo
de las aeronaves, desde el despegue hasta el aterrizaje y estacionamiento. En particular, es durante esta fase del vuelo cuando la información aeronáutica es crítica, ya que en ellas se concentran el mayor porcentaje de incidencias y accidentes aéreos.

Resumen

En el 2014, el Centro de Información Cartográfica y Territorial de Extremadura (CICTEX) puso en explotación la IDE Didáctica de Extremadura, un proyecto que obtuvo uno de los «Geospatial World Awards 2016» concedidos por el Geospatial World Forum. Pasada la puesta en explotación, se llevaron a cabo iniciativas para recoger las opiniones de usuarios y de la comunidad educativa y de donde surgieron nuevos desarrollos: IDE Atlas e IDE Aventura,
y una plataforma de colaboración. IDE Atlas facilita el acceso a la información de manera estructurada, a nivel de Extremadura, España, Europa y el mundo, según sea la temática, mediante el uso de mapas, estadísticas y otros recursos. En IDE Aventura se juega a través de preguntas y geolocalizaciones. Ofrece la posibilidad de lanzar campañas: «curso escolar», «semana de Europa», ajustando el juego a la temática. Las preguntas se generan a partir de una base de datos PostGIS, común para toda la IDE Didáctica y desde la que también se genera servicios WMS y WFS compartidos por IDE Visualiza, IDE Atlas e IDE Aventura. Por último, la plataforma colaborativa está pensada para que colectivos interesados puedan participar en la mejora constante del geoportal, informando de fallos, formulando preguntas, alimentando la BD, etc.

Resumen

El Ayuntamiento de Madrid, productor de datos geográficos en formato digital desde 1995, ha desarrollado y puesto a disposición de la ciudadanía un portal web, en mayo de 2019, como principal canal para la distribución de la información geográfica. Dicho portal se sustenta en una IDE (Infraestructura de datos espaciales) en la que también se han incorporado elementos comúnmente aplicados en los portales de datos abiertos. Junto con los extensos fondos suministrados por el departamento de Cartografía el Geoportal del Ayuntamiento de Madrid tiene como objetivo convertirse en la web de referencia del dato geográfico municipal. El modelo elegido para conseguir la participación de los productores repartidos por las diferentes Áreas del Ayuntamiento se fundamenta en un sistema mixto que permite, tanto la publicación directa del productor, como la publicación delegada a una unidad publicadora central. A partir de la importante acogida registrada en los indicadores de audiencia del Geoportal los principales retos para incrementar el atractivo y mejorar con ellos la aceptación y reputación entre sus usuarios son ampliar la cantidad y diversidad de su catálogo de datos, incluir servicios en formato OGC-INSPIRE, implantar el servicio de nomenclátor e incorporar funcionalidad de valor añadido como los servicios de geoprocesamiento.

Resumen
El proyecto Cross-Forest pretende desarrollar infraestructuras de servicios digitales (DSIs) orientados (i) a la obtención de itinerarios selvícolas que permitan estimar la evolución de las masas forestales y la calidad de la madera a nivel de país y (ii) al control de incendios forestales a través de información precisa sobre materiales combustibles y modelos de propagación. Dichos objetivos se basan en los conjuntos de datos forestales geográficos y alfanuméricos de Portugal y España. Se emplean recursos de computación de alto rendimiento (HPC) debido a la complejidad de los modelos y a la necesidad de realizar numerosas simulaciones con distintas configuraciones. Para ello, Cross-Forest está elaborando una ontología transfronteriza de datos forestales en colaboración con las Administraciones Públicas de Portugal y España, y proporciona un repositorio público (Endpoint) basado en las especificaciones de la Directiva 2007/2/CE (INSPIRE) y de datos abiertos enlazados (LOD) para publicar los datos forestales según la ontología producida. El modelo y la publicación de
datos abiertos puede ser utilizable por profesionales forestales y ciudadanía en general, que, de esta forma, pueden tener acceso completo y fácil a los datos forestales producidos por España y Portugal. Asimismo, el análisis de la propagación y evolución de incendios puede resultar de gran utilidad para los gestores implicados.

Implementación de la Directiva INSPIRE en Portugal. Estado actual P. 46-54

Paulo Patrício, Danilo Furtado, Vanda Bica, Alexandra Fonseca, Ana Luísa Gomes, André Serronha, Henrique Silva, Sérgio Ferreira, Mário Caetano

Resumen
El tiempo transcurrido después de la transposición de la Directiva europea INSPIRE a la legislación portuguesa justifica un análisis sobre la aplicación de la presente Directiva en Portugal: lo que ha cambiado, qué logros se obtuvieron, pero también qué queda por hacer. Portugal tiene un nuevo geoportal para la Infraestructura Nacional de Datos Espaciales – SNIG, desarrollado con GeoNetwork. Este geoportal incluye nuevas funcionalidades para facilitar y hacer más eficiente la búsqueda y visualización de datos espaciales. La implementación de INSPIRE en Portugal dio lugar a la definición de nuevas especificaciones técnicas para producir cartografía de referencia a gran escala, basada en las especificaciones de datos y directrices técnicas de INSPIRE. Analizando el número de metadatos de datos espaciales portugueses notificados anualmente a la Comisión Europea y el número de datos espaciales disponibles a través de los servicios de visualización y descarga es posible verificar que hay un aumento significativo de los datos espaciales compartidos por autoridades públicas de Portugal. En los últimos 10 años se han superado una serie de barreras para una implementación exitosa de INSPIRE, pero todavía hay desafíos, a saber: tener datos espaciales más conformes compartidos a través de servicios de descarga, tener más datos espaciales que cumplan con las especificaciones de datos de INSPIRE y una mayor participación de los Gobiernos Locales en torno a esta Directiva Europea.

Technometrics, ISSN 0040-1706
Volume 62, number 1 (february 2020)

Abstract
We consider the design of dimensional analysis experiments when there is more than a single response. We first give a brief overview of dimensional analysis experiments and the dimensional analysis (DA) procedure. The validity of the DA method for univariate responses was established by the Buckingham Π-Theorem in the early 20th century. We extend the theorem to the multivariate case, develop basic criteria for multivariate design of DA and give guidelines for design construction. Finally, we illustrate the construction of designs for DA experiments for an example involving the design of a heat exchanger.

Abstract
Response surface designs (RSDs) are a core component of the response surface methodology, which is widely used in the context of product and process optimization. In this contribution, we consider three-level RSDs, which can be viewed as matrices with entries equal to $\{-1,0,1\}$. Each column of an RSD corresponds to a factor and each row to an experimental test. We define a new family of orthogonal RSDs, for which there is no aliasing between the main effects and the second-order effects (two-factor interactions and quadratic effects). Using integer programming techniques, we construct a database of 55,531 such RSDs for 3–7 factors. We name these designs orthogonal minimally aliased RSDs (or OMARS designs). Each design in the catalog is extensively characterized in terms of efficiency, power, fourth-order correlations, fraction of design space plots, projection capabilities, etc. We identify interesting designs and investigate trade-offs between different quality criteria. Finally, we present a multiattribute decision algorithm to select designs from the catalog. An important result of our study is that we discovered some novel and interesting designs that challenge standard RSDs.

Abstract
Abstract–Definitive screening designs permit the study of many quantitative factors in a few runs more than twice the number of factors. In practical applications, researchers often require a design for *m* quantitative factors, construct a definitive screening design for more than *m* factors and drop the superfluous columns. This is done when the number of runs in the standard *m*-factor definitive screening design is considered too limited or when no standard definitive screening design (sDSD) exists for *m* factors. In these cases, it is common practice to arbitrarily drop the last columns of the larger design. In this article, we show that certain statistical properties of the resulting experimental

design depend on the exact columns dropped and that other properties are insensitive to these columns. We perform a complete search for the best sets of 1–8 columns to drop from sDSDs with up to 24 factors. We observed the largest differences in statistical properties when dropping four columns from 8- and 10-factor definitive screening designs. In other cases, the differences are small, or even nonexistent.

Constructing D-Efficient Mixed-Level Foldover Designs Using Hadamard Matrices P. 48-56

Nam-Ky Nguyen, Tung-Dinh Pham & Phuong Vuong Mai

Abstract

This paper introduces a new class of Hadamard matrix-based mixed-level foldover designs (MLFODs) and an algorithm which facilitates the construction of MLFODs. Our new MLFODs were constructed by converting some 2-level columns of a Hadamard matrix to 3-level ones. Like the 2-level foldover designs (FODs), each new MLFOD was constructed by a half fraction and its foldover. Our Hadamard-matrix based MLFODs are compared with the conference matrix-based FODs of Jones & Nachtsheim (2013) in terms of the D-efficiencies and the maximum of the absolute values of the correlation coefficients among the columns of the model matrix. Like the latter, our designs are also *definitive* in the sense that the estimates of all main effects are unbiased with respect to any active second order effects. In addition, they require fewer runs and can be used to study the presence of the second-order effects more efficiently. Examples illustrating the use of our new MLFODs are given.

Optimal Blocked and Split-Plot Designs Ensuring Precise Pure-Error Estimation of the Variance Components P. 57-70

Kalliopi Mylona, Steven G. Gilmour & Peter Goos

Abstract

Textbooks on response surface methodology generally stress the importance of lack-of-fit tests and estimation of pure error. For lack-of-fit tests to be possible and other inference to be unbiased, experiments should allow for pure-error estimation. Therefore, they should involve replicated treatments. While most textbooks focus on lack-of-fit testing in the context of completely randomized designs, many response surface experiments are not completely randomized and require block or split-plot structures. The analysis of data from blocked or split-plot experiments is generally based on a mixed regression model with two variance components instead of one. In this article, we present a novel approach to designing blocked and split-plot experiments which ensures that the two variance components can be efficiently estimated from pure error and guarantees a precise estimation of the response surface model. Our novel approach involves a new Bayesian compound D-optimal design criterion which pays attention to both the variance components and the fixed treatment effects. One part of the compound criterion (the part concerned with the treatment effects) is based on the response surface model of interest, while the other part (which is concerned with pure-error estimates of the variance components) is based on the full treatment model. We demonstrate that our new criterion yields split-plot designs that outperform existing designs from the literature both in terms of the precision of the pure-error estimates and the precision of the estimates of the factor effects.

A New Process Control Chart for Monitoring Short-Range Serially Correlated Data P. 71-83

Peihua Qiu, Wendong Li & Jun Li

Abstract

Abstract–Statistical process control (SPC) charts are critically important for quality control and management in manufacturing industries, environmental monitoring, disease surveillance, and many other applications. Conventional SPC charts are designed for cases when process observations are independent at different observation times. In practice, however, serial data correlation almost always exists in sequential data. It has been well demonstrated in the literature that control charts designed for independent data are unstable for monitoring serially correlated data. Thus, it is important to develop control charts specifically for monitoring serially correlated data. To this end, there is some

existing discussion in the SPC literature. Most existing methods are based on parametric time series modeling and residual monitoring, where the data are often assumed to be normally distributed. In applications, however, the assumed parametric time series model with a given order and the normality assumption are often invalid, resulting in unstable process monitoring. Although there is some nice discussion on robust design of such residual monitoring control charts, the suggested designs can only handle certain special cases well. In this article, we try to make another effort by proposing a novel control chart that makes use of the restarting mechanism of a CUSUM chart and the related spring length concept. Our proposed chart uses observations within the spring length of the current time point and ignores all history data that are beyond the spring length. It does not require any parametric time series model and/or a parametric process distribution. It only requires the assumption that process observation at a given time point is associated with nearby observations and independent of observations that are far away in observation times, which should be reasonable for many applications. Numerical studies show that it performs well in different cases.

A Diagnostic Procedure for High-Dimensional Data Streams via Missed Discovery Rate Control P. 84-100

Wendong Li, Dongdong Xiang, Fugee Tsung & Xiaolong Pu

Abstract

Monitoring complex systems involving high-dimensional data streams (HDS) provides quick real-time detection of abnormal changes of system performance, but accurate and efficient diagnosis of the streams responsible has also become increasingly important in many data-rich statistical process control applications. Existing diagnostic procedures, designed for low/moderate dimensional multivariate process, may miss too much important information in the out-of-control streams with a high signal-to-noise ratio (SNR) or waste too many resources finding useless in-control streams with a low SNR. In addition, these procedures do not differentiate between streams according to their severity. In this article, we formulate the diagnosis problem of HDS as a multiple testing problem and provide a computationally fast diagnostic procedure to control the weighted missed discovery rate (wMDR) at some satisfactory level. The proposed procedure overcomes the limitations of conventional diagnostic procedures by controlling the wMDR and minimizing the expected number of false positives as well. We show theoretically that the proposed procedure is asymptotically valid and optimal in a certain sense. Simulation studies and a real data analysis from a semiconductor manufacturing process show that the proposed procedure works very well in practice.

A Class of Tests for Trend in Time Censored Recurrent Event Data P. 101-115

Jan Terje Kvaløy & Bo Henry Lindqvist

Abstract

Statistical tests for trend in recurrent event data not following a Poisson process are generally constructed for event censored data. However, time censored data are more frequently encountered in practice. In this article, we contribute to filling an important gap in the literature on trend testing by presenting a class of statistical tests for trend in time censored recurrent event data, based on the null hypothesis of a renewal process. The class of tests is constructed by an adaption of a functional central limit theorem for renewal processes. By this approach a number of tests for time censored recurrent event data can be constructed, including among others a version of the classical Lewis–Robinson trend test and an Anderson–Darling type test. The latter test turns out to have attractive properties for general use by having good power properties against both monotonic and nonmonotonic trends. Extensions to situations with several processes are considered. Properties of the tests are studied by simulations and some asymptotic calculations, and the approach is illustrated in data examples.

Tensor Mixed Effects Model With Application to Nanomanufacturing Inspection P. 116-129

Xiaowei Yue, Jin Gyu Park, Zhiyong Liang & Jianjun Shi

Abstract

Raman mapping technique has been used to perform in-line quality inspections of nanomanufacturing processes. In such an application, massive high-dimensional Raman mapping data with mixed effects is generated. In general, fixed effects and random effects in the multi-array Raman data are associated with different quality characteristics such as fabrication consistency, uniformity, and defects. The existing tensor decomposition methods cannot separate mixed effects, and existing mixed effects model can only handle matrix data but not high-dimensional multi-array data. In this article, we propose a tensor mixed effects (TME) model to analyze massive high-dimensional Raman mapping data with complex structure. The proposed TME model can (i) separate fixed effects and random effects in a tensor domain; (ii) explore the correlations along different dimensions; and (iii) realize efficient parameter estimation by a proposed iterative double Flip-Flop algorithm. We also investigate the properties of the TME model, existence and identifiability of parameter estimation. The numerical analysis demonstrates the efficiency and accuracy of the parameter estimation in the TME model. Convergence and asymptotic properties are discussed in the simulation and surrogate data analysis. The case study shows an application of the TME model in quantifying the influence of alignment on carbon nanotubes buckypaper. Moreover, the TME model can be applied to provide potential solutions for a family of tensor data analytics problems with mixed effects.

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