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## NATIONALITY

Colombian

## LANGUAGES:

Spanish (native) and  
English. French (passive).

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## EDUCATION

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| <b>Ph. D.</b> , Mineral Economics. The Pennsylvania State University, University Park PA. <i>Thesis: "Optimal Pricing and Investment in Electric Power Generation in the Context of Uncertainty."</i> | 1991-1995. |
| <b>Specialist</b> , Advanced Mathematics. Universidad Nacional de Colombia, Bogotá, Colombia. 1985-1988.  | 1985-1988  |
| <b>Specialist</b> , Energy Systems Management. Universidad de los Andes, Bogotá.  | 1987-1988. |
| <b>Electrical Engineer</b> . Universidad de los Andes.  | 1973-1977. |

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## PROFESSIONAL POSITIONS HELD

**MEMBER, ADVISORY COMMITTEE ON PROJECT STRUCTURING.** National Infrastructure Agency of Colombia (ANI). Report to ANI's Board of Directors. Since May 2012.

**MEMBER, PRESIDENTIAL COMMISSION OF INFRASTRUCTURE EXPERTS.** Appointed to this task force created by President Santos to advise on transport concessions. 2012.

**STRATEGY ADVISOR.** IE and International Gas Supply Corp. August 2014-. Corporate strategy of a holding company and Member of the Board of Directors of 6 subordinate companies.

**DIRECTOR.** Interdisciplinary Center for Development Studies (CIDER). January 2013-July 2014. Universidad de los Andes, Bogotá. Professor of Mining, Growth and the Environment (master's course), Game Theory in Economic Development (undergraduate elective) and Leader of the MOOC course (in alliance with the IDB, to be released in edX) *Water: Latin American Abundance, Global Scarcity*.

**DEPUTY DEAN FOR RESEARCH.** School of Engineering, June 2011-December 2012. Universidad de los Andes, Bogotá. In charge of the Ph. D. Program, research and funding policy. Professor of Dynamical Systems and Businesses on Technological Platforms.

**DIRECTOR.** CELSIA (electricity sector company). Member of the Board of Directors since 2009.

**ASSOCIATE PROFESSOR.** School of Management, January 2007-May 2011. Universidad de los Andes, Bogotá. Member of the Finance Group. Lecturer of the Ph. D. Program in Management (Contract Theory, Theory of the Firm, Game Theory) and the Ph. D. Program in Economics (Mathematical Methods). Research focused on energy policy, regulated industries, the economics of contracts and infrastructure financial arrangements. Professor of Project Financing, Corporate Finance, Real Options.

**SENIOR INFRASTRUCTURE SPECIALIST.** (Sustainable Development Department, Inter-American Development Bank, IDB). Washington, D. C. July 2004-December 2006.

Continuation, deepening and extension of tasks and responsibilities undertaken in the previous role of Infrastructure Specialist at the IDB.

Achievements (other than publications and support to loan operations) include:

- Commissioned to support the Colombian Government in the start-up of its National System of Competitiveness (June-September 2006).
- Organizer and Technical Coordinator of the Seminar "Business Climate for Private Infrastructure Investment in Latin America." Annual Meeting of the IDB. Belo Horizonte, Brazil, April 2, 2006.
- Team Leader of the Operation to write the Manual: Cost-Benefit Analysis in Transport Projects with the Universidad de Las Palmas de Gran Canaria (Spain).
- Team Leader of the Operation to support the integration of gas markets in South America. Representation of the IDB in Ministerial Meetings held at Montevideo, Buenos Aires, Asunción and Lima between June and October 2005.
- Co-organizer of the joint IDB-World Bank conference "Infrastructure in Latin America: Recent Evolution and Key Challenges", Washington, D.C., June 6, 2005. In charge of the session on the political economy of social acceptance of reforms.

**INFRASTRUCTURE SPECIALIST** (Sustainable Development Department, Inter-American Development Bank). Washington, D. C. August 2000-June 2004.

- Eligibility and credit review of bank operations in infrastructure (loans, guarantees and technical cooperation; both private and public; about 75 projects in 21 countries).
- Assessment, review and recommendations of/for assigned Bank policy documents; preparation of inputs for several policies, strategies and guidelines (including Energy, Water and Sanitation and Natural Disasters).
- Analytical work in (i) contracts, financial structures, governance mechanisms and regulation in transport, electricity, gas, telecoms and transnational infrastructure projects; (ii) political economy analysis and institutional recommendations for electricity reforms; and (iii) rural infrastructure. Commissioning and supervision of about 20 applied research papers. Editor of 5 issues of the IFM Bulletin.
- Organization of international conferences, including the Washington and Lima IDB 2004 seminars on Increasing Infrastructure Investments in Latin America and the Caribbean; and of internal workshops (Regulation and Finance of Transnational Infrastructure Projects, 2001).

- In-the-field advice to operations and tasks in 15 countries of the Region, including: a Policy-Based loan for Colombia; support to the World Bank Team in charge of a Colombia Sustainable Development SAL/TAL for Colombia (2004); a multi-sector infrastructure loan to Haiti (2003); and advice to the Sub-commission of Transport Concessions of Plan Puebla-Panama (2003).
- Support to drafting Memorandums of Understanding between the IDB and the Western Hemisphere Transportation Initiative (WHTI), and between the IDB and the International Civil Aviation Organization (ICAO).
- Representation of the Bank in international technical seminars and policy-making events.
- Representation of the Sustainable Development Department in internal committees and panels, including Quality at Entry Exercises (2003, 2004, 2005), peer review of several Loan Committee projects and Internal Evaluation of Transportation Projects (2005).

**ASSOCIATE RESEARCHER.** FEDESARROLLO. Bogotá. November 1999-August 2000. Infrastructure and Energy Economics.

**EXTERNAL PROFESSOR.** Ph. D. Program, Department of Economics, Universidad Nacional de Colombia, Bogotá. First Semester, 2000 (The Economics of Contracts); First Semester, 2001 (Evolutionary Game Theory); Second Semester 2002 (Evolution of Institutions); Second Semester 2004 (Political economy: redistribution and property rights).

Master's Program in Regulation, Universidad de Los Andes, Bogotá. Second Semesters of 2003, 2004, 2005 and 2006 (Module on The Political Economy of Infrastructure Regulation). Latin American University Regulation and Infrastructure Network (LAURIN).

**VISITING PROFESSOR.** Department of Economics and Enterprise, University of Salamanca (Spain). March-May 1999. Seminars on Industrial Organization and the Economics of Contracts.

**ASSOCIATE PROFESSOR.** Department of Industrial Engineering, August 1995-August 2000. Universidad de los Andes. Master's Courses taught: Nonlinear Programming, Dynamic Programming, Investment under Uncertainty, Industrial Organization, Game Theory, Regulation Theory, Economics of Contracts. Undergraduate courses taught: Stochastic Processes, Linear Programming, Discrete Time Finance. Adviser of more than 20 master's theses and 60 undergraduate theses in real and financial options, mechanism design, regulation and mathematical modeling.

**ASSISTANT PROFESSOR.** Department of Electrical Engineering, 1989-1991. Universidad de los Andes, Bogotá. Courses taught: Linear Systems, Signal Processing, Information Theory, Circuit Theory, Energy Economics, Algebraic Control Theory.

**DIRECTOR, ENERGY GROUP.** 1990-1991. Universidad de los Andes, Bogotá. Coordination of the Energy Systems Management Graduate Program (joint program with the United Nations University in Tokyo). Studies and Projects Engineer. Electrolima, Ibagué, Colombia, 1981-1988. Electric power systems planning, operations planning, and control center coordination; distribution network design.

**ASSISTANT ENGINEER.** Electrolima, Prado Hydro-Power Plant, Colombia, 1978-1981. Plant operation, maintenance coordination, time series hydrological modeling.

**SOFTWARE ENGINEER.** Schiemann, Kraus and Company, Bogotá, 1977. Management Information Systems design and implementation.

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## TECHNICAL PUBLICATIONS

- *Insumos para el desarrollo del Plan Nacional de Ordenamiento Minero* (e-book). 2014. Juan Benavides (editor and author of one chapter). Bogotá, Colombia: Ediciones Uniandes. Funded by UPME. ISSN e-book: 978-958-774-026-4. Available at: <http://cider.uniandes.edu.co/@Publicaciones/PublicacionesCoedicion/PlanOrdenamientoMinero.pdf>
- “Foreign investment, institutional quality, public expenditure and venture capital funds in emerging market countries.” 2014. Hernán Herrera, Jerry Haar and Juan Benavides. *Global Economy Journal* 14: 127-162. ISSN: 1524-5861.
- “Foreign direct investment, institutional quality, economic freedom and entrepreneurship in developing markets.” 2014. Hernán Herrera, Jerry Haar and Juan Benavides. *Journal of Business Research* 67: 1921-1932. ISSN: 0148-2963.
- “Do Institutional Quality, Economic Freedom and Entrepreneurship Impact Foreign Direct Investment in Emerging Markets?” 2013. Hernán Herrera, Jerry Haar and Juan Benavides. *Technology and Management for Development Center (TMD) Working Paper (TMD-WP-57)*. University of Oxford. ISSN: 2045-5119.
- “Institutional and Political Frameworks of Environmental Licensing Processes.” 2013. Diana Arbeláez, Juan Benavides and Bárbara Oñate. Centre for Social Responsibility in Mining (CSRMI). The University of Queensland, Australia. Available at: <http://im4dc.org/wp-content/uploads/2013/09/Institutional-and-Political-Frameworks-of-Environmental-Licensing-Processes1.pdf>
- “Instituciones, investigación e innovación en Colombia.” 2013. Chapter 12 in Luis E. Orozco (compilador), *La educación superior: retos y perspectivas*. Bogotá, Colombia: Libros blancos de la Universidad de los Andes. Pp. 447-481. ISBN: 978-958-695-919-3.
- “Estrategia energética de Colombia en el contexto del cambio climático.” 2013. In Martha Cárdenas and Manuel Rodríguez (eds.) *Desarrollo económico y adaptación al cambio climático*. Bogotá, Colombia: Friedrich Ebert Stiftung in Colombia and Foro Nacional Ambiental. Pp. 189-214. ISBN: 978-958-8677-08-8.
- “Promoción de la competencia en telefonía móvil en Colombia.” 2012. Juan Benavides (Director) and Felipe Castro. Fedesarrollo. Available at: [http://www.fedesarrollo.org.co/wp-content/uploads/2011/08/Promoci%C3%B3n-de-la-competencia-en-la-telefon%C3%ADa-m%C3%B3vil-de-Colombia-Subasta-4G\\_def.pdf](http://www.fedesarrollo.org.co/wp-content/uploads/2011/08/Promoci%C3%B3n-de-la-competencia-en-la-telefon%C3%ADa-m%C3%B3vil-de-Colombia-Subasta-4G_def.pdf)
- *Comisión de Infraestructura - Informe*. 2012. Report delivered to the President of Colombia (Member of the Commission). Available at: <http://www.fedesarrollo.org.co/wp-content/uploads/2011/08/Comisi%C3%B3n-de-Infraestructura-Informe-October-2012.pdf>
- “Concesiones viales: Construyendo transparencia.” 2012. Roberto Steiner, Juan Benavides, Santiago Jaramillo and Daniel Wiesner. Fedesarrollo. Funded by the British Embassy in Colombia. Available at: <http://www.fedesarrollo.org.co/wp-content/uploads/2011/08/Road-Concessions-Building-Transparency1.pdf>

- “Impacto de las tecnologías de la información y las comunicaciones (TIC) en el desarrollo y la competitividad de Colombia.” 2011. Juan Benavides (Director), Felipe Castro, Lina Devis and Mauricio Olivera. Fedesarrollo. Funded by ANDESCO (National Association of Public Utilities of Colombia). Available at: <http://www.fedesarrollo.org.co/wp-content/uploads/2011/08/Impacto-de-las-Tecnolog%C3%ADas-de-la-Informaci%C3%B3n-y-las-Comunicaciones-TIC-Informe-Final-Andesco.pdf>
- “Financiación de infraestructura y desarrollo urbano.” 2011. Juan Benavides and Mauricio Olivera. Fedesarrollo. Funded by the World Bank (Urbanization Review). Available at: [http://www.urbanknowledge.org/ur/docs/Colombia\\_Urbanization%20Infrastructure.pdf](http://www.urbanknowledge.org/ur/docs/Colombia_Urbanization%20Infrastructure.pdf)
- *Ecopetrol 60 años. Energía limpia para el futuro.* 2011. (Juan Benavides: Editor and author of two chapters). Bogotá: Villegas Editores. ISBN 978-958-9287-30-9. On-line version available at: <http://www.ecopetrol.com.co/especiales/libro60años/esp/cap11.htm>
- “Innovación en hidrocarburos en Colombia.” 2011. *Revista de Ingeniería* 34: 83-85. ISSN: 0121-4993. Available at: <https://revistaing.uniandes.edu.co/pdf/A8%20D.pdf>
- “Setting up standard power options to hedge price-quantity risk in a competitive electricity market: the Colombian case.” 2011. Gabriel A. Vizcaíno, Juan M. Alzate, Angela I. Cadena, Juan M. Benavides. *IEEE Transactions on Power Systems* 26: 1493-1500. 2011. ISSN: 0885-8950.
- “Análisis del proceso de integración y convergencia en telecomunicaciones: experiencia internacional, el caso colombiano.” 2011. Juan Benavides (Director), Verónica Navas and Andrés Escobar. Fedesarrollo. Funded by Comcel. Available at: <http://www.fedesarrollo.org.co/wp-content/uploads/2011/08/Informe-Final-Comcel-abril-28-de-2011.pdf>
- “Políticas y capacidades de investigación y desarrollo e innovación para el desarrollo de biocombustibles en América Latina y el Caribe.” March 2011. Juan Benavides and Angela Cadena. Policy paper commissioned by the Food and Agriculture Organization (FAO) and the Economic Commission for Latin America and the Caribbean (ECLAC). Santiago, Chile. Available at: <http://www.cepal.org/ddpe/agenda/2/42932/innovaciondialogopoliticas.pdf>
- “Evaluación económica de proyectos de transporte.” 2010. Project led by Ginés de Rus (Universidad de las Palmas de Gran Canaria). Funded by Ministerio de Fomento de España. Invited Researcher. Available at: <http://www.evaluaciondeproyectos.es/EsWeb/Resultados/Manual/PDF/EsManual.pdf>
- “El sector de gas natural.” July 2010. *Perspectivas y desafíos de los servicios públicos domiciliarios y TIC en Colombia 2010-2014. Una agenda para el próximo gobierno.* Policy paper for ANDESCO.
- “Reformas para atraer la inversión privada en infraestructura vial.” 2010. In Steiner, R. and V. Traverso (eds.) *Colombia 2010-2014: Propuestas de Política Pública.* CAF- Fedesarrollo. Pps. 279-320. Funded by Fondo Germán Botero de los Ríos (Fedesarrollo). ISBN: 978-958-99348-2-1.
- “El desarrollo económico de la Orinoquia como aprendizaje y construcción de instituciones.” 2010. In Steiner, R. and V. Traverso (eds.) *Colombia 2010-2014: Propuestas de Política Pública.* CAF- Fedesarrollo. Pps. 279-320. Funded by CAF. Pps. 375-420. ISBN: 978-958-99348-2-1.
- “Selecting Infrastructure Delivery Mechanisms: No Time for Ideology or Semantics.” Vives, A., J. Benavides and A. Marcarino Paris. 2010. *Journal of Construction Engineering and Management* 136:

412-418. ISSN: 0733-9364/4-412-418.

- “Public procurement methods to enhance private investments in infrastructure.” 2009. Antonio Vives and Juan Benavides. Presented by A. Vives at the LEAD 2009 Conference (Lake Tahoe, California). October. Available at: [http://www.epossociety.org/LEAD2009/Vives\\_Benavides.pdf](http://www.epossociety.org/LEAD2009/Vives_Benavides.pdf)
- “El mercado de la energía eléctrica en Colombia: características, evolución e impacto sobre otros sectores.” 2009. Mauricio Santa María, Nils-H. von der Fehr, Jaime Millán, Juan Benavides, Orlando Gracia and Erika Shutt. *Cuadernos de Fedesarrollo: # 30*. Available at: <http://www.fedesarrollo.org.co/wp-content/uploads/2011/08/Cuaderno-No.-30.pdf>
- “Contracts and institutional design in transport projects.” November 2008. M. P. Socorro and J. Benavides. Working paper. CEDEX Project (Universidad de las Palmas de Gran Canaria).
- “A Social Accounting Matrix for Valle del Aburrá.” October 2008. Working paper. J. Benavides, A. Cadena, L. Escobar and J. Sánchez.
- “Políticas y programas para la promoción del capital de riesgo y el capital privado en Colombia: Nota introductoria.” August 2008. Working Paper. Uniandes School of Management.
- “Cuatro micro-ensayos sobre infraestructura y geografía en Colombia.” May 2008. Working Paper. Uniandes School of Management. <http://cec.uniandes.edu.co/pdf/articulo2.pdf>
- “Analysis of the firm energy market proposal for the Colombian Electricity market. 2008. Alzate, J. M., A. Cadena y J. Benavides. 2008 *Proceedings of the IEEE PES Transmission and Distribution Conference and Exposition*. Bogotá, August 13-15. ISBN: 978-1-4244-2218-0. ID: 205. Available at: <http://www.maincomweb.com/T&D/title.htm>
- “Financial Structuring of Infrastructure Projects in Public-Private Partnerships.” 2008. Vives, A., J. Benavides y A. Paris. Chapter in H. A. Davis (Ed.) *Infrastructure Finance: Trends and Techniques*, pp. 284-302. London, UK: Euromoney Books. ISBN: 978-1-84374-282-1. <http://www.euromoneybooks.com/images/covers/Infrastructure%20Finance%20Trends%20and%20Techniques/Infrastructure%20Finance%20-%20Author%20Biographies.pdf>
- “Precios, inversión y economía política de la energía eléctrica.” 2007. *Revista de Ingeniería Uniandes* 25: 122-131. ISSN versión escrita: 0121-4993.
- “Subsidios eléctricos en América Latina y el Caribe: Análisis comparativo y recomendaciones de política.” 2006. Carla Pantanali and Juan Benavides. Working Paper. Sustainable Development Department. Washington, DC: IDB.
- *Financial Structuring of Infrastructure Projects in Public-Private Partnerships: An Application to Water Projects*. 2006. Antonio Vives, Angela M. Paris, Juan Benavides, Peter D. Raymond, Darío Quiroga and Javier Marcus. Washington, DC: IDB. HC79.C3 F46 2006, 363.6 F46 ---dc22. Felipe Herrera Library, IDB. <http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=904262>
- “Privatization and Regulation in Latin America.” 2006. Alberto Chong and Juan Benavides in Eduardo Lora (Ed.) *The Reform of the State in Latin America*, Chapter 8, pp. 263-289. Stanford, CA: Stanford University Press. ISBN-10 0-8213-6575-5 (World Rights except North America).

- “Design Issues in Rural Infrastructure Interventions.” Juan Benavides. *IFM Review* vol. 12, No 1. March 2006.
- *Private Infrastructure and the Inter American Development Bank 1990-2005*. 2006. Juan Benavides (Ed.). Washington, D.C.: Inter-American Development Bank. Sustainable Development Department.
- “Incentive Contracts for Infrastructure, Litigation and Weak Institutions.” 2005. Alfredo Garcia, James Reitzes and Juan Benavides. *Journal of Regulatory Economics* 27: 5-24. ISSN: 1573-0468 (Online).
- *Gas Market Integration in the Southern Cone*. 2005. Paulina Beato and Juan Benavides (Eds.). Washington, DC: IDB. ISBN: 1-931003-90-4.
- *Recouping Infrastructure Investment in Latin America and the Caribbean – Selected Papers from the 2004 IDB Infrastructure Conference Series*. 2005. Juan Benavides (Ed.). Sustainable Development Department. (English and Spanish versions). Washington, DC: IDB. 332.67 R878 --dc22. Felipe Herrera Library, IDB.
- “Public-Private Partnerships: From Plain Vanilla to Local Flavors.” Juan Benavides and Antonio Vives. *IFM Review* vol. 11, No 2. June 2005.
- “Economía política de las finanzas y subsidios del sector eléctrico de Guatemala.” 2004. Juan Benavides y Manuel Dussan. Serie de informes técnicos del Departamento de Desarrollo Sostenible. Washington, DC: IDB.
- “Lecciones aprendidas en PROVIAS Rural (Perú) y pautas para diseñar operaciones de infraestructura rural.” 2004. Javier Escobal, Marisol Inurritegui y Juan Benavides. Serie de informes técnicos del Departamento de Desarrollo Sostenible. Washington, DC: IDB.
- “Forces Affecting the Gas Integration Process in the Southern Cone.” Paulina Beato and Juan Benavides. *IFM Review* vol. 10, No 2. June 2004.
- “Managing Risks of Infrastructure Investment in Latin America: Lessons, Issues, and Prescriptions.” 2004. Working Paper. IDB/SDS. John Strong, José-Luis Guasch and Juan Benavides. Washington, DC: IDB.
- *Private Infrastructure and the Inter American Development Bank 1990-2003*. 2004. Juan Benavides (Ed.). Washington, DC: IDB. 363.6 P282 2003 --dc21. Felipe Herrera Library, IDB.
- “Infrastructure and Rural Poverty: Coordination of Policies and Interventions in Latin America and the Caribbean.” 2003. Juan Benavides. Working Paper (In Spanish and English). IDB/SDS. Washington, DC: IDB.
- “Honduras: The Road to Sustainable Reform.” 2003. Ian Walker and Juan Benavides in J. Millán and N. von der Fehr (Eds.) *Keeping the Lights on: Power Reform in Latin America*, Chapter 3, pp. 163-215. Baltimore, MD: The Johns Hopkins University Press. ISBN: 1931003556.
- “Competition Policy for Mobile Telephony in Latin America.” Carlos Lapuerta, Sonia Jorge and Juan Benavides. *IFM Review* vol. 9, No 4. December 2003.

- "Laboratorio de incentivos: La experiencia de la privatización en Colombia." 2003. Julio César Alonso, Juan Benavides, Israel Fainboim and Carlos Jorge Rodríguez in A. Chong and J. M. Rodríguez (Eds.) *Medios privados para fines públicos*, Chapter 4, pp. 149-246. Washington, DC: IDB. ISBN: 1931003521.
- "Can Reforms Be Made Sustainable? Analysis and Design Considerations for the Electricity Sector." 2003. Juan Benavides. Technical Paper (In Spanish and English). Washington, DC: IDB.
- "Regulation and Competition in Mobile Telephony in Latin America." 2003. Carlos Lapuerta, Juan Benavides and Sonia Jorge. Working Paper RES. Washington, DC: IDB.
- "Natural Disaster Management and the Road Network in Ecuador: Policy Issues and Recommendations." 2002. Scott Solberg, Juan Benavides and David Hale. Working Paper. Washington, DC: IDB.
- "The Institutional Reform of Electricity in Honduras." Ian Walker and Juan Benavides. *IFM Review* vol. 8, No 2. June 2002.
- "Private Participation in Infrastructure in Colombia - Renegotiation and Disputes." 2002. Juan Benavides and Israel Fainboim in F. Basañes and R. Willig (Eds.) *Second-Generation Reforms in Infrastructure Services*, Chapter 4, pp. 89-132. Baltimore: The Johns Hopkins University Press. ISBN: 1931003017.
- *Private Infrastructure and the Inter American Development Bank 1990-2001*. 2001 Juan Benavides (Ed.). Washington, DC: IDB.
- "Comments on the Manifiesto on the California Electricity Crisis." Juan Benavides. *IFM Review* vol. 7, No 1. March 2001.
- "Participación privada en proyectos de infraestructura y determinantes de los esquemas contractuales: El caso colombiano." 2001. Julio César Alonso, Juan Benavides, Israel Fainboim and Carlos Jorge Rodríguez. Research Department. Document R-412. Washington, DC: IDB.
- "Political Economy of (De)regulatory Reforms in the Power Sector." Juan Benavides. *IFM Review* vol. 6, No 4. January 2001.
- "Reforma Institucional del Sector de Infraestructura y Servicios Públicos de la Ciudad de Bogotá." 2000. Juan Benavides. Institutional Mission for the City of Bogotá.
- "Impact of mineral royalties on investment in regional governments." 2000. Juan Benavides, Alberto Carrasquilla y Juan Zapata. Bogotá: FEDESARROLLO.
- "Optimal Allocation of Electricity after a Major Earthquake: Market Mechanisms vs. Rationing." 1999. A. Rose and J. Benavides in K. Lawrence et al. (Eds.) *Advances in Mathematical Programming and Financial Planning*. Greenwich, CT: JAI Press. pp. 147-168. ISBN-13: 978-0762301287.
- "Análisis de la Regulación y los contratos de concesión de infraestructura en Colombia." 1999. Juan Benavides and Israel Fainboim in M. Gandour and L. B. Mejía (Eds.) *Hacia el rediseño del estado*. National Planning Board. Bogotá: Tercer Mundo Editores.



- “Crecimiento, calidad ambiental e instituciones (Sección 1, Cap. II).” 1999. In C. Saravia and E. Guerrero (eds.) *Energías para un desarrollo sostenible*. Bogotá: Fondo FEN Colombia.
- “Regional Economic Impacts”. 1998. Adam Rose and Juan Benavides in M. Shinozuka, A. Rose and R. Eguchi (eds.) *Engineering and Socioeconomic Impacts of Earthquakes*, Chapter 7, pp. 95-123. Multidisciplinary Center for Earthquake Engineering Research, State University of New York (SUNY-Buffalo). ISBN: 0-9656682-2-3.
- “Pushing the Reform Ahead in the Colombian Wholesale Electricity Market,” *Proceedings of the 21st Annual International Conference of the IAEE*, May 1998.
- “Capacity Payments in Predominantly Hydroelectric Spot Electricity Markets: The Colombian Experience.” *Proceedings of the 18th Annual North American Meeting of the USAEE/IAEE*, September 1997.
- “The Regional Economic Impact of an Earthquake: Direct and Indirect Effects of Electricity Lifeline Disruptions.” 1997. Adam Rose, Juan Benavides, Stephanie Chang, Phil Szczesniak, Dongsoon Lim. *Journal of Regional Science* 37: 437-458. First published online 17 DEC 2002. Online ISSN: 1467-9787.
- “Global Warming Policy, Energy, and the Chinese Economy.” 1996. Adam Rose, Juan Benavides, Dongsoon Lim, Oscar Frías. *Resource and Energy Economics* 18: 31-63. ISSN: 0928-7655.
- “Interindustry Models for Analyzing the Economic Impacts of Earthquakes and Recovery Policies: Illustrative Examples.” 1997. Adam Rose and Juan Benavides, in Barclay Jones (ed.) *Advances in Social Science Analysis of Earthquakes*. Buffalo, NY: NCEER.
- “Cost-Estimation Methods for New Coal-Based Energy Technologies.” 1993. Juan Benavides, Adam Rose, and Richard L. Gordon. Department of Mineral Economics and The Consortium for Coal Water Slurry Fuel Technology. The Pennsylvania State University. Work performed for U.S. Department of Defense and U.S. Department of Energy.

## PUBLICATIONS IN THE GENERAL PRESS

- Bymonthly columnist of *Portafolio* on economics, education and public policy since 2013.
- “Descubrir la Orinoquia.” *Especial Revista Semana: La nueva Colombia*. 12 de junio de 2011. Página 57. “Colombia, petróleo y crecimiento.” *Revista Gerente*. 29 de marzo de 2011.
- [http://www.google.com/search?hl=es&safe=off&rlz=1T4TSNA\\_enCO358DE359&q=colombia+petr%C3%B3leo+y+crecimiento+juan+benavides&oq=colombia+petr%C3%B3leo+y+crecimiento+juan+benavides&aq=f&aql=&gs\\_sm=s&gs\\_upl=ololololololololololol](http://www.google.com/search?hl=es&safe=off&rlz=1T4TSNA_enCO358DE359&q=colombia+petr%C3%B3leo+y+crecimiento+juan+benavides&oq=colombia+petr%C3%B3leo+y+crecimiento+juan+benavides&aq=f&aql=&gs_sm=s&gs_upl=ololololololololololol)
- “¿Cómo reconstruir la infraestructura afectada por la ola invernal?” *La República*. 7 de febrero de 2011. [http://www.larepublica.com.co/archivos/ECONOMIA/2011-02-07/-como-reconstruir-la-infraestructura-afectada-por-la-ola-invernal-\\_121083.php](http://www.larepublica.com.co/archivos/ECONOMIA/2011-02-07/-como-reconstruir-la-infraestructura-afectada-por-la-ola-invernal-_121083.php)
- “Perspectivas de integración regional del gas natural en América Latina y el Caribe.” 2008. *El observador de los servicios públicos* 1: 106-118. Revista de la Superintendencia de Servicios Públicos Domiciliarios de Colombia (SSPD). Bogotá, junio. [http://www.superservicios.gov.co/siteSSPD/documentos/documentos\\_pub/279\\_3334.pdf](http://www.superservicios.gov.co/siteSSPD/documentos/documentos_pub/279_3334.pdf)

- “Cómo dinamizar las reservas de gas.” *Portafolio*. 30 de octubre de 2008, p.18. <http://www.portafolio.com.co/archivo/documento/MAM-3164762>.

## TECHNICAL PRESENTATIONS IN INTERNATIONAL MEETINGS

- “Colombia: How to Attract Private Investment in Infrastructure.” Infrastructure Opportunities and Challenges. Global Infrastructure Forum. Organized by CRGP, Stanford University. Cartagena, Colombia. February 2-3, 2012.
- “Diseño de políticas de contratación de la concesiones viales en Colombia.” Primer Foro Internacional – Interdisciplina y espacios sustentables. Guanajuato, México: Universidad de Guanajuato. May 27, 2011.
- “Local institutions and water firms’ structure and governance.” First International Forum on regulation of water services and sustainability. Associazione Nazionale Autorità e Enti di Ambito (AneA). Rome (Italy), January 21, 2009.
- “A unified model of contract renegotiation with and without hold up.” Universidad de las Palmas de Gran Canaria (Spain). CEDEX Project (Evaluación económica y financiera de proyectos de transporte). Las Palmas, June 30, 2008.
- “Energy for Competitiveness.” Conference on the Caribbean: a 20/20 Vision. The World Bank and the Inter-American Development Bank. Washington, DC. June 19, 2007.
- “Public-Private Partnership Design and the Local Context: Development Impacts.” 2nd Annual PPP Americas Summit. Washington, D. C., December 7, 2005.
- “Integración de la Red de Gasoductos del Sur.” I Encuentro Empresarial Iberoamericano. Salamanca (Spain), October 13, 2005.
- “The IDB Santa Catarina Road Program: Lessons and Recommendations.” *International Seminar on Improving the Quality of Public Investment and Public-Private Partnerships*. Organized by the Ministries of Finance and Planning of Brazil and the International Monetary Fund (IMF). Brasilia, April 25-27, 2005.
- “Challenges of Infrastructure Reforms in Latin America”. LACEA 2004 9th Annual Meeting, San José, Costa Rica. November 6, 2004.
- “Political Economy of the Electricity Reforms.” POWER MEX Conference, Mexico City. September 9, 2004.
- “Road Projects, Sector Reform, Contribution to Economic Growth and Investment Needs: A Latin American Perspective.” International Road Federation. 2004 Meeting. Washington, D. C., August 4, 2004.

- “Energy Sector Policy, Natural Resource Rents and Sustainable Development.” *Strategic Environmental Assessment Workshop for the Ecuadorian Energy Sector*. IDB and The World Bank. Quito, December 9, 2003.
- “Oportunidades y retos de los proyectos público-privados.” *Seminar on Public-Private Partnerships in Mexico*. Mexican Chamber of Consultancies. Mexico City, November 14, 2003.
- “Civil Society Participation and Electricity Reforms.” *Seminar on Public Involvement in the Electricity Sector*. USAID. Washington, D. C., May 29, 2003.
- “Regulation and Competition in Mobile Telephony in Latin America”. *First Meeting of the Latin American Competition Forum*. OECD-IDB. Paris, April 7-8, 2003.
- “Economía política e instituciones: el otro lado de la luna de las reformas eléctricas,” CIDEL Argentina 2002. Buenos Aires, December 4, 2002.
- “Transport Regulation, Highway Concessions and Economic Growth,” *Highway 2000: A Critical Review and Implications*. Public Information Forum. Development Bank of Jamaica. Kingston, Jamaica, September 1, 2001.
- “Expansión y cobertura del servicio de energía eléctrica,” V Seminario Internacional sobre Análisis y Mercados Energéticos. Universidad Nacional de Colombia - Sede Medellín. Universidad de los Andes. Bogotá, 15-17 agosto 2001.
- “Private Participation in Infrastructure in Colombia - Renegotiation and Disputes: Six Case Studies,” *Second Generation Issues in the Reform of Public Services*. Workshop organized by the IDB. Washington, D.C., 3-4 October 1999.
- “Problemas teóricos y empíricos en mercados eléctricos competitivos. Caso colombiano,” *Modelos de Planeación y Mercados para el Sistema Eléctrico Colombiano*. UPME. Bogotá, May 13-14, 1999.
- “Irreversible Investment and the Role of Contracts in Imperfectly Competitive Electricity Markets,” *INFORMS 98*. Tel Aviv (Israel), June 28-July 1, 1998.
- “Adapting the Ascending Simultaneous Auction to PCS Allocations in Colombia,” *International Telecommunications Society (ITC). 20th Biennial Conference*. Stockholm (Sweden), June 21-24, 1998.
- “Pushing the Reform Ahead in the Colombian Wholesale Electricity Market,” *21st Annual International Conference of the USAEE/IAEE*, Québec City (Canada), May 13-16 1998.
- “The Institutional Problems of Regulation in Colombia,” *First International Seminar of Institutional Analysis and Design*. National Planning Board of Colombia (DNP). Bogotá, April 27-29, 1998 (with I. Fainboim).

- “Capacity Payments in Predominantly Hydroelectric Spot Electricity Markets: The Colombian Experience,” 18th Annual North American Meeting of the USAEE/IAEE, San Francisco, CA, September 1997.
- “Imperfect Competition in the Colombian Electricity Market,” Mónica Hernández and Juan Benavides. Seminar on Competition, Investment and Regulation in Telecommunications and Electricity. Universidad de los Andes, July 1, 1997.
- “Real Options, Capital Valuation and Electricity Derivatives,” Marcela Loboguerrero and Juan Benavides. Seminar on Competition, Investment and Regulation in Telecommunications and Electricity. Universidad de los Andes, July 1, 1997.
- “Socially Optimal Investment in Electric Power Generation.” Nordic Workshop on The Modelling of Energy Markets under Uncertainty. University of Iceland. Reikjavik, June 6-7, 1997.
- “Experiences of the Colombian Electricity Regulatory Reform.” 17th Annual North American Meeting of the USAEE/IAEE, Boston, MA, October 1996.
- “Variational Inequalities for Investment in Electric Power Generation.” INFORMS 96. Washington D.C., May 1996.
- “Differentiated Prices Schemes of Hydrothermal Power Generation: Models and Policy for Developing Countries.” First Joint International Symposium: Energy Models for Policy and Planning (London Business School/International Federation of Operational Research Societies - IFOR). London, UK, July 18-20, 1995.
- “Lifeline Capacity Expansion Planning Under Uncertainty.” Juan Benavides and Adam Z. Rose. 41th North American Meeting of the Regional Science Association International. Niagara Falls, Canada, November 20-23, 1994
- “Optimal Recovery and Reconstruction of Lifelines After Major Earthquakes.: Juan Benavides and Adam Z. Rose. 1994 American Association for the Advancement for Science (AAAS) Annual Meeting. San Francisco, CA, February 18-23, 1994.
- “Incremental Cost of Greenhouse Gas Reduction in Power Sector Expansion and Operation: Calculation and Policy Issues.” Workshop on Incremental Costs of Reducing Net Emissions of Greenhouse Gases in The Power Sector. Latin American Energy Organization (OLADE)-Global Environment Facility (GEF) Cooperation Program. Quito, Ecuador, November 23, 1993.
- “Economic Analysis of Lifelines in Recovery and Reconstruction.” Adam Z. Rose and Juan Benavides. 40th North American Meeting of the Regional Science Association International. Houston, Texas, November 11-14, 1993.
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- “Irreversibility and Uncertainty in the Expansion of Power System Capacity: A Methodology for Latin America.” (In Spanish). Energy Conference of Latin America and the Caribbean (ENERLAC 93). Latin American Energy Organization (OLADE). Bogotá, June 15-18, 1993.

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## CONSULTANT EXPERIENCE SINCE 2007

- Second semester of 2013: Institutional and actor analysis for climate change policy making in Bogotá-Cundinamarca (for PRICC, funded by UNDP); Inputs for the National Mining Plan (for UPME; coordination of 16 diagnostic and recommendations papers); Inputs for Vive Digital 2 (for MINTIC, in collaboration with other Colombian universities and the MIT).
- March 2012-May 2013. Inter-American Development Bank. Economic Analysis of “Colombia- Programa de apoyo a la participación privada en infraestructura (PAPP)” (CO-L1131).
- August 2012-February 2013. Inter-American Development Bank. Economic Analysis of Program “Apoyo a la Implementación de la Política Nacional Logística - Sector Transporte” (CO-L1109).
- September 2011-March 2012. “Colombia. Road Concessions: Building Transparency.” (In Spanish). Roberto Steiner, Juan Benavides, Armando Montenegro, Sergio Jaramillo, Alejandro Linares.
- Fedesarrollo. Funded by the Foreign and Commonwealth Affairs, UK Embassy in Colombia.
- 2011. “Evaluación económica de proyectos de infraestructura.” On-line course developed with Antonio Vives (leader) for Latin American public officers. Platform support: CEDDET (Madrid, Spain). Project sponsored by Corporación Andina de Fomento (CAF).
- May 2011-December 2011. “Propuestas para la reestructuración de la pequeña minería del carbón del interior de Colombia.” Natalia Salazar, Pilar Cabrera, Juan Gonzalo Zapata, Juan Benavides, Lina Devis. Fedesarrollo. Funded by Ministerio de Minas y Energía.
- April 2010-April 2011. National Planning Department of Colombia (DNP). “Policies for hydrocarbon transformation in Colombia.” Angela Cadena, Juan Benavides, Juan Carlos Salazar, Martha Rodríguez, Christian Ketels (Harvard Business School).
- August 2011-October 2011. NATURGAS (Colombian Association of Natural Gas Utilities). “Riesgo y remuneración de la distribución de gas natural en Colombia.” Juan Benavides, Angela Cadena, Javier Serrano, Gabriel Vizcaíno. Uniandes.
- January 2010-June 2010. “Asesoría y acompañamiento al Gobierno Nacional en el análisis de priorización de las estrategias de movilidad a implementar en la Región Capital Bogotá-Cundinamarca.” Jorge Acevedo, Juan Pablo Bocarejo, Miguel Urrutia, Juan Benavides.
- October 2009-August 2010. “Selección, evaluación y mejoramiento del impacto de proyectos de infraestructura.” Antonio Vives and Juan Benavides. Workshops conducted at Buenos Aires, Quito and Caracas for public officers and Corporación Andina de Fomento (CAF) staff.
- July 2009-October 2009. Colombian automotive assembly firms. Diagnosis and strategy formulation study (with Juan Carlos Echeverry).
- July 2008-February 2009. Inter-American Development Bank. Cost-benefit analysis of the Pasto Mocoa road, for INVIAS (Instituto Nacional de Vías), Colombia.

- April 2008-December 2008. NATURGAS. Calculation of the WACC for natural gas transport and distribution firms (with Javier Serrano, Francisco Azuero and Eric Rodríguez, Uniandes).
- September 2007-April 2008. Corporación Andina de Fomento (CAF), for the Minister of Finance, Colombia. “Alternativas de adjudicación de de proyectos de concesión vial en Colombia.”
- June 2007-April 2008. US AID. Review and proposals for natural gas transport regulation reform in Colombia.
- May 2007. Inter-American Development Bank. Identification of institutional strengthening issues and plan for ENERSA (Electricity Utility of Entre Ríos, Argentina).
- April 2007-October 2007. ACOLGEN (Colombian Association of Electricity Generators). Comments and recommendations for the Descending Clock Auction (DCA) for Firm Energy Obligations in the Colombian Wholesale Electricity Market (with Shmuel Oren, U. of California –Berkeley, Angela Cadena (Uniandes) and Alfredo García , U. of Virginia).
- April 2007-July 2007. ASOCODIS (Colombian Association of Electricity Distributors). Calculation of the WACC for regulated distribution utilities (with Javier Serrano, Francisco Azuero and Eric Rodríguez, Uniandes).

## CONSULTANT EXPERIENCE PRIOR TO JOINING THE IDB

### Advisor.

August 1995-August 1997. Colombian Electricity and Gas Regulatory Commission (CREG). Contribution to implementation of the wholesale electricity market regulatory measures. Analysis of anti-competitive behavior, design of capacity payment, guidelines for coordination between gas and electricity dispatch, contracting and regional market integration.

### Expert Witness.

October-November 1999. The Colombian Nation vs. A Cellular Telephony Operator. Calculation of residual asset values of a cellular telephony BOT concession.

### Reform Analysis and Design.

January 2000-July 2000. Office of the Major. City of Bogotá. Institutional Mission: Redesign of the City Institutions in Infrastructure Services (Transportation, Housing, Civil Works).

August 1998-August 1999. Consultant for the Inter-American Development Bank. Analysis of six infrastructure conflicts in Colombia to assess the scope of renegotiation of private participation (three in electricity markets, two highway franchises, one in cellular telephony). With Israel Fainboim.

### Energy Markets and Regulation.

- July-September 1999. CREG. Design of an incentive compatible mechanism for quality regulation in electricity distribution networks.
- June-July 1999. Planning Unit of the Ministry of Energy and Mines (UPME), Colombia. Impacts on

Competition and Entry in the Wholesale Electricity Market due to selling the San Carlos hydroelectric plant.

- January-May 1999. Chivor, S. A (Power generator). Economic Analysis of the Colombian Spot Electricity Market.
- December 1998-January 1999. UPME. Workshop on regulation of electric transmission and review of the auctioning scheme of new link additions.
- November 1998-January 1999. Booz Allen & Hamilton. Strategy for Power Generation Development Using Natural Gas from the Camisea Project. Republic of Perú.
- February-March 1998. Booz Allen & Hamilton and K&M. Specification of the settlement mechanism for bilateral contracts in the Ecuadorian Spot Electricity Market (with Don Hertzmark). Republic of Ecuador.
- October 1997. Booz Allen & Hamilton. Review of capacity requirements in the Colombian generation market.
- October 1997. Econometría Ltda. Regulation and privatization of generation assets (for Banco Bilbao Vizcaya, Spain).
- October 1997. Empresas Públicas de Medellín. Assessment of the electricity regulatory reform and its impact on asset values (with Pablo Spiller, U. of California, Berkeley and LECG).
- April 1997. National Planning Board (DNP). Infrastructure Division. Energy Infrastructure and Economic Growth.
- Fall 1993- Fall 1995. National Science Foundation. Project: Optimal Recovery and Reconstruction of Lifelines after Major Earthquakes. Multidisciplinary Center for Earthquake Engineering Research (MCEER). Co-principal investigator (with Adam Rose). Penn State University.

#### **Telecommunications and Water Regulation and Strategy.**

- May 2000-July 2000. TELECOM (Colombia). Calculation of infrastructure fees to be charged to publicly owned TV channels.
- April 2000-June 2000. TV Channels A and One franchisers. Development of a tariff scheme for TV time and implementation with the Colombian National Commission of Television.
- December 1998-September 1999. Design of a negotiation strategy for network interconnection in telecommunications for a long distance operator in Colombia (with Bridger Mitchell (Charles River Associates) and Glenn Woroch (U. of California, Berkeley)).
- November 1998-September 1999. Ministry of Telecommunications of Colombia and National Science Fund, COLCIENCIAS. Interconnection Policies and Universal Service Provision in Telecommunications.
- February 1998-May 1998. Colombian Water and Sanitation Regulatory Commission (CRA). Compilation of regulatory literature on water and sanitation.
- September 1997. Ministry of Telecommunications, Colombia. Computation of the access fee for new long-distance operators (with I. Fainboim).
- June 1997. Colombian National Commission of Television. Revision of the franchise value of the two National TV channels through the income elasticity of net marketing investment (with J. Leibovich).

#### **Risk Modeling, Fiscal Policy and Private Finance.**

- April 2000-July 2000. CORREVAL (Investment Bank), Bogotá. Computation of contingent liabilities of the City of Bogotá for the ALO (Avenida Longitudinal de Occidente) Highway Project .
- November 1999-April 2000. Arthur Andersen and the Ministry of Finance (Colombia). Design of a Monte Carlo computational tool to assess the contingent liabilities of the Colombian government of seven infrastructure projects (two power plants, two highway concessions, two water works, and an airport concession).
- August 1998. Electricidad de Caracas. Financial Valuation of Metroeste, Chiriquí and Nordeste

distribution firms. Republic of Panama.

- June-July 1998. Electricidad de Caracas and DecisionWare. Financial Valuation of Electrocosta and Electrocaribe distribution firms. Privatization process of CORELCA. Successful bid (US\$ 1 billion).
- November-December 1994. Colombian Petroleum Company (ECOPETROL). Development of real options models (binomial lattices) for oil exploration and development decisions.

#### **Environmental and Natural Resource Economics.**

- September 1999-June 2000. UPME and Tecnogerencia. Strategic Environmental Assessment -SEA- of the Colombian Energy Sector.
- December 1997. Ministry of the Environment (Colombia). Biodiversity management and access rules to biodiverse areas.
- October 1993-January 1994. The World Bank and the Global Environment Facility. Program for Measuring Incremental Costs for the Environment of the Global Environment Facility (GEF).
- Summer Intern 1992. Sponsor: Resources for the Future (RFF), Washington D.C. Energy and Natural Resources Division. Project: Economic Development, Environmental Conditions and Policy Design in Central and Eastern Europe (led by Michael Toman).

#### **FELLOWSHIPS AND GRANTS.**

Recipient of Fulbright, Organization of American States, Encyclopaedia Britannica and COLCIENCIAS fellowships to conduct doctoral studies.

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## **REFERENCES**

Available upon request.  
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