

Pillars-ECLAC-ifo-Workshop on

Labor Market Effects of Automation and Technology Adoption in the Global Economy

Santiago de Chile, 1 – 2 June 2023

Thursday (01/06/2023)

Welcome Address, Jose Manuel Salazar-Xirinachs, Executive Secretary, ECLAC

- “The impact of digital technologies and automation on the region’s labor markets will be beneficial to the extent that countries put clear policies for productive development and human talent development into effect, in order to transform the growth model and develop more sophisticated productive activities that would enable the creation of quality jobs,”
- **“It’s not possible to create a better future for work without creating a better future for production.** These are two sides of the same coin”
- “In order to create decent jobs, it is indispensable that we focus on a productive transition to greater levels of investment and productivity, which means that **investment in education and vocational training is also crucial.**”



Policy Panel: Automation, digital technologies, and labor markets: policy options for Latin America and the Caribbean

- **Chair:** Jose Manuel Salazar-Xirinachs, Executive Secretary, ECLAC
- Pablo Mieres, Minister of Labour and Social Security, Uruguay (online)
 - o “The best response to the future of work is to have a **cutting-edge education, with eyes and ears attuned to labor market trends**”
- Fabio Bertranou, Director, ILO Office for the Southern Cone
 - o “The discussion about the future of work has to go hand in hand with the discussion about the future of production”
 - o **Productivity-enhancing policies essential**
- Paulo Bastos, Senior Economist, Development Research Group of the World Bank, Trade and International Integration Unit
 - o Automation and technology can bring important benefits in terms of productivity, but also challenges, especially in terms of income distribution
 - o To benefit from technology-induced productivity gains, it is important that the **labor market be allowed sufficient flexibility with regard to technology adoption**, but policies must also be implemented to ensure **workers’ security** in order to minimize the effects on them and their families

Scientific Workshop

Keynote Lecture

Christian Volpe Martincus (Inter-American Development Bank) *Trade Policy Meets Digital Technologies: How Digitalization of Trade Procedures Affects Firms’ Exports*

- Authors show that digitalization (case study: introduction of electronic single window in Costa Rica for handing in documents for exports) facilitates regulatory compliance and thereby boosts firms’ exports
- Background: Firms selling products abroad usually have to interact with several border agencies that develop multiple trade regulations and oversee their compliance. These regulations establish the procedures that these firms have to follow and the documents that they have to obtain, fill in, and submit for their exports to be authorized. ***In the 1990s in Costa Rica, 16 entities issuing 20 authorizations in addition to the national customs intervened in the export process. Until the mid-1990s all these entities used different documents, which had to be presented in person in their respective different locations throughout the country’s capital, San Jose. After being processed, these documents had to be delivered also in person at the corresponding customs office. As a consequence, completing the formalities of the export process rarely took less than five days and often much longer***
- **In the mid-2000s, Costa Rica moved to an electronic trade single window.** A single document was then required to be filled in just once online and the system automatically distributed it among the entities that, according to the norms, had to issue permits –thus without the need to go to a physical office or physically submit the form to these entities. For exporting firms, this allowed for a significant streamlining of the procedures and specifically



for a reduction in the resources (and potentially the time) spent in dealing with the formalities associated with trade activities and, crucially, a shorter response time in the handling of their authorization requests.

- The authors investigate the export effects of digitization in the form of the introduction of an electronic single window.
- They use firm-level export data from Costa Rica over the period 2007-2013 and exploit the gradual phase-in of an electronic trade single window scheme across groups of products and ports.
- **They find that the electronic single window has led to both an expansion in the number of exporting firms, the number of exported products and the export volume by buyer.**

Daisuke Adachi (Assistant professor, Aarhus University)

Robots and Wage Polarization: The Effects of Robot Capital by Occupations

- Robotics has been substituting or complementing workers in a wide range of occupations. Daisuke shows that there is a **high degree of heterogeneity across occupations**. To examine the strength of this substitutability, Daisuke matches unique data on imported robot prices with the occupational task information for the US to measure the cost of using robots by occupation.
- The data show that a 10% reduction in the cost is associated with a 1.2% reduction in wages for production and transportation occupations in the US, suggesting strong substitutability in these occupations.
- For other occupations, however, Daisuke estimates that robots and labor are neither substitutes nor complements. **This implies that the adoption of industrial robots has significantly affected wage polarization in the US across occupations.**
- In a counterfactual exercise Daisuke finds that a robot tax could increase the US real income in the short run but leads to a decline in the income in the long run due to the decreased steady-state robot stock.

Federico Huneeus (Senior Economist at Central Bank of Chile)

Earnings Inequality in Production Networks

- Research question: Why do firms differ in the wages paid to otherwise identical workers and in the share of revenue that they allocate to labor?
- This paper highlights the role of **production networks**.
- Using linked employer-employee and firm-to-firm trade transactions data from Chile, they show that **firms with better access to both buyers and suppliers of intermediate inputs tend to have higher earnings premia (pay higher wages) and lower labor shares**
- Federico presented a production network model which shows that greater access to larger buyers and more efficient suppliers raises the marginal revenue product of labor and lowers the relative cost of intermediates to labor. This leads to higher wages in the presence of labor market power and lower labor shares when labor and materials are substitutes. Through counterfactual simulations of the estimated model they find that production networks play an important role in explaining the variances of earnings premia and labor shares across firms.

Andreas Baur (ifo, LMU)

North-South Trade: The Impact of Robotization

- Research question: **How does robotization in high-income countries affect exports from firms in the global South to the Global North?**
- Our findings highlight the **importance of taking into account supply chain linkages and suggest net positive effects of robotization in the North for Southern exporters.**
- Using a novel combination of data sources including firm-level export data for Latin American countries, input-output linkages, and robot adoption, we show contrasting implications for Southern firms. Increased exposure to robot adoption in the destination country of exports reduces firm-level exports in case of robot adoption in the same industry. However, the opposite holds when accounting for input-output linkages and trade along the value chain.
- We outline a North-South trade model with endogenous robot adoption that accounts for the different channels shown in the data.

Katherine Stapleton (World Bank, online)

AI and Services-Led Growth: Evidence from Indian Job Adverts

- 1. They document **near-exponential growth in the demand for artificial intelligence (AI)-related skills in India's services sector since 2016, using a new dataset of online vacancies from its largest jobs website.**
- 2. Evaluate the effects of growth in the demand for AI skills on the growth of non-AI job postings and wage offers at the establishment level (using an event study, and medium term using a shift-share design that exploits variation in exposure to new AI inventions). Growth in AI demand has a significant negative effect on growth in non-AI and total postings at the establishment level and average wage offers. The effects are most pronounced in high-skilled managerial and professional occupations and non-routine work, particularly complex analytical and communication tasks. ==> **AI lowers demand for occupations that are typically non-routine task intensive, in contrast to previous recent waves of technological change that lowered demand for routine tasks.**

Lisandra Flach (ifo, LMU)

Robotizing to Compete: Evidence from the Eastern European Enlargement

- Research question: What is joint impact of product market competition on automation investments, employment and firm performance?
- The empirical analysis exploits a rich combination of micro data on **Portuguese firms** and workers
- Shock (product market competition): tariff liberalization between the European Union and Central and Eastern European countries in the 1990s, which increased the degree of competition faced by Portuguese exporters.
- Findings: **Stronger competition in export markets tends to reduce investments in labor saving technologies, while also lowering employment, especially of low-skilled workers.** These effects are driven by the least productive firms, as more efficient producers are able to divert sales to other markets. Moreover, firms reallocate sales towards the best products. The results indicate an increase in export concentration both within and between firms in response to competition.



Nicolas Guida-Johnson (Boston University)

Automation and Gender: Implications for Occupational Segregation and the Gender Skill Gap

- Research question: Are there differential effects of automation on the labor market and educational outcomes of women relative to men over the past four decades?
- **Although women were disproportionately employed in occupations with a high risk of automation in 1980, they were more likely to shift to high-skill, high-wage occupations than men in the subsequent decades.**
- We estimate causal effects by exploiting variation in local labor market exposure to automation attributable to historical differences in local industry structure. Based on U.S. Census data from 1980 to 2017 the authors find that for a given change in the exposure to automation across commuting zones, **women were more likely than men to shift out of routine task-intensive occupations to high-skill, high-wage occupations over the subsequent decade.**
- The net effect is that initially, routine-intensive local labor markets experienced greater occupational gender integration. College attainment among younger workers, particularly women, also rose significantly more in areas more exposed to automation.
- To understand these patterns, we develop a simple model of occupational choice with endogenous educational investments **where women have a comparative advantage in social skills.** Supporting the model mechanisms, areas with greater exposure to automation experienced a greater movement of women into occupations with high math and high social skill requirements than men.

Friday (02/06/2023)

Álvaro Lalanne (ECLAC)

Offshoring, trade in tasks and labor markets in Uruguay

- **What are the effects of technology and globalization on job distribution in Uruguay?**
- The effect of international trade automation on employment is not trivial for a country like Uruguay, which does not base its competitiveness on segments with high technological content or low wages.
- To study this impact, a database that relates exposure to international trade and the potential for offshoring with occupation and tasks
- The analysis reveals that during the commodity boom, there was an increase in medium-skilled jobs. However, technological advancements and offshoring in the past decade have created imbalances in the labor market, with shortages of skilled occupations and surpluses of blue-collar jobs in the tradable sector.
- **Policy implication: investments in education and job training policies to correct these imbalances.**

Thao Trang Nguyen (UNU-MERIT and Maastricht University)

Beyond Job Displacement: Examining the Effects of Automation Adoption on Firms' Export Performance using French Firm-level Data

- Research question: **How does automation technologies affect firms' export activity in France (2002 to 2017).**
- Findings: **automation adoption is associated with an increase in exports value, number of exported products, and number of exported countries.** However, the dynamic treatment effect model reveals a more complicated relationship, with a smaller magnitude of increase in exports value and number of exported products after two years. Our findings also suggest that automation technologies can improve product quality and adjusted unit price.

Jürgen Weller (ECLAC)

The risk of technologically triggered job destruction – a view from Latin America

- **The effect of technological transformations will be a change in the way of working and jobs, rather than their complete destruction.**
- Technology adoption in Latin America faces several barriers.
- **The role of education, training and skills development systems, as well as the gender focus of these systems, are key to this adaptation,** taking into account the technological and educational gaps existing in the region.

Keynote Lecture

Paulo Bastos (World Bank)

Robots, tasks, and trade

- Research question: What the effects of robotization on North-South trade patterns, wages and welfare?
- The empirical analysis exploits variation in exposure to robots across countries and sectors (cross-country analysis)
- Finding: greater robot intensity in own production leads to
 - o a rise in imports sourced from less developed countries in the same industry
 - o an even stronger increase in exports to those countries.
- To explain these findings we develop a stylized Ricardian model ==> **An increase in robot adoption in the North increases trade in final and intermediate goods with the South, and is likely to increase wages and welfare**



Carlos Corseuil (Ipea Rio de Janeiro)

The Impact of Digital Technology on Worker Tasks: Do Labor Policies Matter?

- Authors exploit administrative and survey data for Brazil
- Background:
 - o **Between 1999 and 2006, Brazilian cities experienced strong growth in the provision of internet services**
 - o **Stringent labor market institutions** exist to protect workers from technology-driven displacement, but these labor market regulations also constrain firms from adjusting the work-force to perform new tasks, and fully benefiting from technology adoption.
- Findings:

- **Digital technology adoption shifts labor demand toward the increased performance of non-routine activities and use of cognitive abilities.**
- **Restrictive labor regulations differentially benefit the most skilled workers, particularly those workers employed in non-routine and cognitive tasks.**

Jeanne Lafortune (UC Chile)

Powering Up Productivity: The Effects of Electrification on U.S. Manufacturing

- Research question: **what was the effect** one of the most significant technological transformations of modern times: **the electrification of manufacturing production?**
- Data set at the city-industry level for **the US from 1890 to 1940** to identify the impact of electricity on manufacturing industries. We exploit cross-industry variation in energy use intensity before the arrival of electricity combined with geographic variation in proximity to early hydroelectric power plants.
- Findings:
 - **Labor productivity gains from the appearance of electricity were relatively rapid and long-lasting.** Electricity induced output growth without corresponding increases in employment.
 - Electricity induced capital deepening, fall of labor share. **Moreover, electrification led to lower shares of middle-skill jobs and higher ones for low-skill jobs.**
 - Electricity's effects vary with the degree of product market structure: in sector-county pairs where the average firm was initially large, we find no significant expansion in employment, while in markets with relatively small firms, both output and employment increased, as expected in competitive markets.
- "While these results have some historical value because they improve our understanding of one of the most significant technological revolutions of the recent past, the results we document are in many ways similar to more modern technological changes. Given that these occurred in a different environment, our work suggests that there may be a consistent "link" between new technologies and labor markets"

Thomas Fackler (ifo, LMU)

Defying Gravity: What Drives Productivity in Remote Teams?

- Research question: How can teams organize for productive online collaboration?
- Empirical analysis using fine-grained data from the world's largest platform for open-source software development (github),
- Findings:
 - **Geographic proximity still matters for knowledge workers.** We find that the pandemic reduced the productivity of previously co-located teams substantially, whereas teams with remote work experience remained resilient.
 - While access to remote talent and experience are important for overall success, these results highlight the crucial role of communication for productive online collaboration.
 - Suggestive evidence that, with their peers shifting to online work, remote workers become better integrated into their teams' communication.
- Conclusion: while teams' performance may suffer from the shift to remote work, **setting up systems for effective online communication can help mitigate productivity loss.**

