CompNet Annual Conference

20th and 21st June 2024, Central Bank of Malta, Binja Laparelli

Day 1

Thursday, 20th June 13h10 – 18h00

Professor Edward Scicluna, Governor of the Central Bank of Malta, inaugurated the 13th CompNet Annual Conference with a welcoming speech on the relevance of the event, given the significance of productivity and competitiveness in today's challenging economy. He stressed the importance of investigating productivity, noting Europe's need to enhance it through technological advances and well-reasoned regulation. He concluded by thanking CompNet, the organizing team, and the attendees for the event.

Filippo di Mauro, Chairman of CompNet, opened the conference with a brief presentation on CompNet's main activities, including dataset production, publications, research and events. In particular, he remarked the key milestones reached with the CompNet and MDI datasets, underlining the research opportunities offered by this data. He finally wished everyone a pleasant conference.

Keynote by Prof. Gianmarco Ottaviano (Bocconi University and CEPR)

Prof. **Ottaviano**'s keynote speech discussed his recent study on productivity and competitiveness using CompNet data, emphasizing Europe's lag in technological innovation. He noted evolving definitions of competitiveness and distinguished between internal and external competitiveness. He highlighted the importance of comparative advantage and presented his recent research with CompNet exploring its different aspects, including export propensity, technology, and productivity across countries. Initial findings reveal mismatches in Europe's expected and actual comparative advantages. After presenting these preliminary results, Prof. Ottaviano remarked the importance of data for research in these matters and concluded by praising CompNet's data for its analytical value.

Session 1 – Geopolitical Risk and Fragmentation

Paper 1 – "Inputs in Geopolitical Distress: Risk Assessment Based on Micro Data" by Gianmarco Cariola (Bank of Italy)

Presentation

The authors try to identify foreign critical inputs (FCIs) for five EU countries (Belgium, France, Italy, Slovenia, Spain) and assess the impact of foreign chain disruption on value added. FCIs are defined as products included in the US Census in the ATP list, raw material for green transition, or inputs defined from EU Commissions are characterized by foreign dependencies. These inputs are imported mainly from China, and then US. Stylized facts show that FCIs importers count for 70% of BFISS manufacturing value-added. Moreover, FCIs counts for a modest share of firms' total purchases (6% on average), but with high variability. Also, diversification of sources is limited for FCIs. Finally, FCIs importers are more productive. To assess the impact of external shocks considering the previous stylized facts, the authors rely on partial equilibrium framework from Bachman et al. (2022), with heterogeneity in production functions. The change in manufacturing value added is, hence, a function of share of intermediate inputs and the size of the shock, and the applied shocks are made of risk, defined as firm level exposure to external shocks, and cut, a measure of intensity of the shock. The model is calibrated with firm-level data. Value added drop is found varying among firms. Many firms experience a big decrease in value added after the external shock, while another group of firms experience a small drop. Mainly, there is an inverse relationship between firm size and decrease in value added. Heterogeneity is also present at the regional level: it depends on the concentration of firms and on some idiosyncratic characteristics, such as specialization in certain exposed sectors.

The Discussion by **Tommaso Bighelli** (IWH, CompNet), who highlighted the policy relevance of the paper, with insightful cross-country comparisons. He also suggested to include data until 2023 to see whether the situation changed after the recent geopolitical events. Moreover, it would be interesting to check what happened to the most exposed firms and to analyse the heterogeneity of response by firms that are in Chinese multinational groups. Finally, it would be useful to disentangle between prices and quantities responses.

Q&A

Carlo Altomonte (Bocconi University) remarked that if FCIs are critical, they should enter the production function in a Leontief form. Other forms could deliver a downward bias.

Maarten De Ridder (LSE) asked if the paper was analysing the time horizon and the direction of elasticity of substitution. Gianmarco Cariola explained that they change elasticity of substitution exactly to check different horizons. Changing the parameter is also due to uncertainty about the parameter itself.

Paper 2 – 'The transmission of trade shocks across countries: firm-level evidence from the Covid-19 crisis' by Aurelija Proskute (Bank of Lithuania)

Presentation

The work explores how the COVID-19 pandemic impacted international trade, particularly in the Baltic States (Latvia, Estonia, and Lithuania). The pandemic caused significant disruptions in global value chains (GVCs) due to workplace closures and other measures, leading to declines in trade and economic activity even in countries not severely affected by the virus.

Key findings include:

- Both imports and exports saw a pronounced decline during the pandemic, although Baltic States experienced smaller reductions compared to the global average.
- The study used a difference-in-differences approach to estimate the impact of lockdowns on firm-level trade data from 2019-2020.
- Upstream shocks (from import origin countries) and downstream shocks (from export destination countries) were distinguished to understand shock propagation.
- COVID-19 restrictions in partner countries negatively affected firm imports and exports in the Baltic States, primarily through intensive margin adjustments and quantity reductions.
- Firms engaged in GVCs or producing more differentiated products experienced varied impacts, with some evidence suggesting less severe effects for those in GVCs.

The study emphasizes the vulnerability of small economies heavily reliant on GVCs to global trade shocks and highlights the importance of understanding shock transmission mechanisms for future resilience.

The Discussion by **Carlo Altomonte** offered a summary of key findings of the paper, followed by a discussion of key methodologies and contribution to existing research. In particular, the discussant remarked how the study confirms previous findings on trade shock reactions and highlights the importance of product heterogeneity and firm characteristics in trade adjustments.

Q&A

During the conference, several important questions were discussed. The role of inventories in mitigating the impact of negative shocks was explored, highlighting how firms manage stock to cushion adverse effects. The extent to which firms respond to shocks in terms of prices versus quantities was also questioned, with a call for more evidence to be provided. The identification strategy using variation over time in firm pair relationships was examined, with a suggestion to incorporate variation across products as well. It was noted that different destination product pairs might be affected differently by the same shock due to varying export-import linkages.

The discussion included the use of classification schemes to assess how different jobs were exposed to Covid-19 risk, providing a framework to understand labor market impacts. There was a query about whether the extensive margin is at the firm or product level, seeking clarity on the scope of analysis. The implications of looking at trading services instead of goods were considered, suggesting a need to differentiate between these sectors.
Additionally, the roles of demand versus supply shocks were analyzed, with a focus on the differences between homogeneous and heterogeneous goods. The question of whether homogeneous products were replaced during shocks was raised, aiming to understand substitution effects in the market. Overall, the discussion covered a range of topics crucial for understanding firm behavior and market dynamics in response to economic shocks.

Session 2 – Industry Dynamics

Paper 3 - 'Intangible Intensity and Between-Firm Wage Inequality' by Olga Tcaci (TUD Dresden University of Technology)

Presentation

The presentation explores the link between intangible capital and wage inequality among firms. The study is motivated by the rising reliance on intangible assets such as intellectual property products (IPP), organizational capital, brands, training, R&D, software, and databases. These intangible-intensive technological changes have led to disparities in occupational exposure and increased wage inequality. Utilizing data from the 9th vintage of CompNet and EUKLEMS & INTANProd, the analysis includes 56 industries from 12 European countries over 2000-2020. The researchers hypothesize that increased intangible capital leads to greater wage inequality between firms.
The study measures the impact of intangible intensity on wage inequality using the log of the 90-10 labor costs per employee ratio, incorporating industry, country, and year fixed effects. Controls include average firm age, size, size dispersion, and tangible intensity.
Key findings indicate that intangible intensity is positively correlated with wage inequality between firms, a relationship robust across different model specifications. The study theorizes that skill-biased technological change contributes to wage dispersion, with high-skilled workers employed by larger, more productive firms, exacerbating wage inequality.
The conclusion highlights that the distribution of intangible capital benefits large and superstar firms, driving wage inequality. Intangible assets offer competitive advantages, enable rigorous screening for high-ability workers, and attract higher wages.
This research underscores the significant role of intangible assets in shaping wage structures and inequality within the labor market, suggesting policy implications for addressing wage disparities in an increasingly intangible-driven economy.

The Discussion by **Juan Duran Vanegas** highlighted the study's results, proposing some open questions of high interest, in particular on the role of high-skill intensity as a mechanism, the need for additional evidence linking intangible intensity to productivity dispersion, and the potential use of alternative instrumental variables based on pre-sample intensity in other countries.

Q&A

Massimo Giovannini (Central Bank of Malta) opened the Q&A inquiring about the policy interpretation of results. The author replies that this will come in the future, as the current focus is on the mechanism, empirical side and consistency of results over time. Following comments discussed the possibility to decompose wage inequality (within sector, between and within firm components) and the possibility to use alternative datasets. About this, the author replies that the current plan is to use CompNet's joint distributions as alternative data; however, CompNet offers only data on between firm wage inequality. Final comments include a remark by **Filiz Unsal** (OECD) on the possibility to further investigate the cross-country dimension, while **Carlo Altomonte** (Bocconi

University) suggested to provide a case for the identification strategy at the granular level, using firm-level data on intangibles for a selected number of countries/industries.

Paper 4 – "Trade Protection, Industrial Policy, and the Shaping of Local Preferences" by Eugenio Miravete (University of Texas)

Presentation

This paper examines the impact of substantial industrial policy on automobile manufacturing in Spain, arguing that producing more isn't always better and that industrial policies significantly alter consumer preferences.

The focus is on Spain due to its large automobile industry, contributing about 8% of GDP. The industry began with the state-funded creation of SEAT under Franco's dictatorship, which led to other companies like Renault and Citroen entering the market. Until 1959, Spain operated under an autarchic regime with import restrictions, excluding the Canary Islands. This exclusion meant that Canary Islands consumers didn't develop attachments to local brands, unlike mainland consumers who showed a strong home bias towards locally produced cars.

Post-1986, following the end of import restrictions, there was a convergence in car brand preferences between Spain and the Canary Islands. Notably, regions like Valencia, which had a strong home bias for locally produced cars (e.g., Ford), saw this bias strengthen, while Canary Islands consumers remained indifferent to domestic brands.

The paper addresses whether industrial policy has long-lasting market effects, using an equilibrium oligopoly model that accounts for home-biased preferences. The findings confirm persistent market distortions and a strong bias towards locally produced cars. Estimating prices without bias, the study identifies local producers as clear winners. An experiment reveals that to maintain a 25% market share for domestic vehicles without home bias, Spain would need a 27% tariff.

Overall, the paper underscores the need to understand market concentration in major car-producing countries.

The Discussion by **Massimiliano Pisani** (Banca d'Italia) introduces some general remarks: first, the demand could have been highly influenced by the GFC, affecting a lot the number of car sales. In addition, there might be other policies and other episodes that might have affected the results, other than the industrial policy of interest of the paper. He also casts doubt on the constant returns to scale assumption and on the rational explanation on how the industrial policy affects preferences. Finally, he wonders how the authors justify that the home bias cannot vary by changing the import tariff, in the counterfactual.

Q&A

Gianmarco Cariola (Banca d'Italia) intervened on the origins of home bias, asking if it could be that a firm has home bias since many employees, who have discounts on purchases, influence the firm's local perception, making it more attractive to other people in the area. If that's so, he asked if we could use this to make the sale of electric car effectively take place. The authors answer that no, it is quite unlikely, given that there's not enough employees to affect a whole city's preferences.

Lawrence Schembri (Fraser Institute) suggests getting the difference in the shift in preferences from home bias by estimating hedonic pricing. The authors answer that the issue is that the data about prices goes back to 1970s.

Other remarks by **Richard Bräuer** (IWH) and **Javier Miranda** (IWH) suggest adding more on the policy desirability and preferences generation in the paper, with a deeper explanation on the importance of looking at home bias in industrial products' markets.

Policy Panel: 'Fostering the European Competitiveness' by Filiz Unsal (OECD), Pilar Castrillo (ESM), Debora Revoltella (EIB), Reint Gropp (IWH), Chair: Filippo di Mauro (CompNet)

Chair Filippo di Mauro opened the discussion by emphasizing the importance of addressing European competitiveness and carrying the policy panel on two main topics.

Round 1: Institutional Actions to Enhance Competitiveness

Debora Revoltella (EIB) highlighted a growing GDP per capita gap between the EU and the US, emphasizing investment shortfalls in machinery, equipment, and ICT in the EU. She stressed Europe's innovation issues, noting a lack of top innovators and the challenges in scaling up firms due to limited capital markets. Revoltella advocated for improving skills, social policies, and financial support, particularly for green investments.

Filiz Unsal (OECD) pointed out the EU's slower recovery from COVID-19 and the green transition compared to the US and Asia. She underscored the need for policies enhancing human capital, training, and financing, particularly amidst tighter credit conditions. Improving childcare and labor force participation were also deemed crucial.

Pilar Castrillo (ESM) emphasized structural challenges such as innovation deficits, administrative burdens, and market fragmentation. She noted the EU's need for national reforms, openness, and reduced dependencies while maintaining international market integration.

Reint Gropp (IWH) discussed Germany's productivity, attributing it to human capital and gradual innovation within firms rather than entry-exit dynamics. He called for enhancing human capital and improving the regulatory environment for startups.

Round 2: Internal vs. External Competitiveness

Reint Gropp argued against a one-size-fits-all solution for venture capital and capital market integration, emphasizing the need for removing bureaucratic obstacles for startups. **Debora Revoltella** emphasized the role of financing in innovation and the necessity of public participation to support firm scaling-up, particularly in fragmented European markets. **Filiz Unsal** highlighted the importance of skilled labor and larger markets for sustaining innovation. **Pilar Castrillo** called for harmonization, improved investments, and overcoming fragmentation to boost EU competitiveness.

Key Points

High public debt's impact on investments remains debated, with differing views on its influence on private investments. The European Recovery and Resilience Facility's role was acknowledged, but its implementation could have been improved for better integration and competitiveness. Protectionism was questioned as a tool for EU competitiveness, emphasizing the need for greater European integration.

Chair Filippo di Mauro concluded by thanking the panellists and participants for their insights on enhancing European competitiveness.

Day 2

Friday, 21st June 9h – 15h15

Session 3 – Carbon pricing and Economic Performance

Paper 5 – "Economic performance and climate policy in the EU: Insights from firm-level data" by Maria Garrone (EU Commission)

Presentation

The paper argues that EU policy is not in line with the carbon targets and there is risk of carbon leakage. The EU main tool to reduce carbon emissions is the EU carbon emission tax, which is has been getting more stringent since 2005. The paper focuses on the third phase of this policy (2013-2021) and analyses how the firm's emission performance impacted their corporate performance during this phase. Based on manufacturing firms, the authors create a measure of emission intensity, employing a proxy of emission over production. Then, they implement within-firm estimations. The authors also built a Bartik instrument for IV regressions. They check effect on roa, profit margin, ebitda, labour productivity, and material productivity. Moreover, the competition environment (proxied by import intensity and product specialization) is controlled for. The study finds that competition matters: after controlling for it, strong effects of carbon emissions on firm's performance are detected. Furthermore, the paper suggests that regulated firms still make little effort to decarbonize, since this requires strong investment.

The Discussion by **Gianmarco Cariola** (Bank of Italy), who warns that the error term in the regressions could be still correlated to the regressors if it is autoregressive and suggests expanding the discussion about exclusion restriction and add some robustness analysis to check such assumptions.

Q&A

Marteen De Ridder (LSE) inquired about the credibility of the win-win climate policy within the literature. **Lawrence Schembri** (Fraser Institute) questioned whether the carbon tax system effectively and systematically reduces emissions. **Carlo Altomonte (**Bocconi University) asked if the new measure of emission intensity could be compared with other typical measures and noted that the third phase had an impact on prices primarily in recent years, wondering if larger effects were detected during these years. **Eric Bartelsman** (VU Amsterdam) suggested analysing whether carbon leakage is a concerning feature by using ITGS data linked to the existing data. **Maurin Laurent** (EIB) explored the link with investment. Finally, **Eugenio Miravete** (University of Texas at Austin) asked if the study controlled for exit and expressed scepticism about the necessity of strengthening the standards.

Paper 6 – Special Session – "CompNet Micro-data Infrastructure and Application" by Eric Bartelsman (Vrije Universiteit Amsterdam)

Presentation

Doing research using micro data is complex in terms of access, costs and data management and merging. MDI addresses these issues: it facilitates cross country comparison and removes the other mentioned obstacles. It allows to merge different internal and external sources.

Examples of current research work carried out using the MDI data there is a study of how productivity is channelled through regional European value chains. Additionally, the energy research group looks at how energy efficiency within firms is affected by changes in energy prices and aims at producing a new dataset with product energy-use. The firm dynamics paper looks at unexpected changes in profitability and how this affects intensive and extensive firm response in capital and or labour. The monetary policy paper investigates how new technology impact marginal costs. The results show that Phillips Curves get flatter for heterogeneous firms.

If the data is harmonized at the NSI, running codes is very easy. The way the process works is that researchers get in touch with the MDI team with a research question, after looking at what data is available from the metadata. The MDI team prepares the 'rocket' accordingly and sends it to the NSIs. The different cross-country output is extracted and sent to the researchers.

The MDI team has worked on preparing the metadata for every country's data and eventually producing a catalogue with the availability of all variables for all countries available. At the same time, work has been done to produce tools to use for the related analysis.

Q&A

Maarten De Ridder (LSE) asked if the researchers had considered quantifying macro models using micro data to achieve more precise moment calibration. The response affirmed this approach but noted it was more suited for CompNet data. The MDI, however, offers the capability to explore previously unanswerable research questions. **Carlo Altomonte** (Bocconi University) inquired about the requirement for physical presence in the lab to access Italian data and how that would be managed. The response indicated that collaboration with an academic partner in Italy is necessary.

Session 4 – Growth and Innovation

Paper 7 – "The Aggregate Effects of the Decline of Disruptive Innovation" by Richard Bräuer (IWH)

Presentation

The paper examines the impact of declining disruptive innovation on productivity growth. It identifies a decline in the disruptiveness of patents and scientific publications, with firms increasingly focusing on incremental rather than disruptive innovation. The study employs empirical analysis using data from PATSTAT, a comprehensive patent database, to gather stylized facts about disruptive innovations and their costs.

Brauer builds an endogenous growth model to simulate conditions under which innovation becomes more incremental. The model shows that firms may hinder disruptive innovation to maintain monopoly profits, resulting in a productivity slowdown. The research highlights the declining quality of patents and reduced effectiveness of R&D efforts, contributing to this trend.

Empirical findings are supported by data from over 70 million international patent applications, analyzed using measures like inventor names, technology fields, and citation counts. The paper discusses the decline in the average disruptiveness of innovations over time and matches disrupted and undisrupted technology classes to assess the impact of disruptive innovations.

In conclusion, the paper underscores the need for policies that encourage disruptive innovation to sustain long-term productivity growth and prevent stagnation in technological advancements.

The Discussion by **Olga Tcaci** briefly summarized the paper praising its relevance. The discussant introduced some major comments on the productivity measures specifications, the normalization of patent data and the justification of the disruptiveness threshold. In addition, the discussant proposed some integrations in the model, namely: considering field characteristics, the assumption of linear growth from incremental innovation, the role of inventor specialization and conditions under which incremental inventors become disruptive.

Q&A

Javier Miranda (IWH) inquired about the interpretation of the technological path, proposing an alternative interpretation involving the burden of knowledge, where advancing the technological frontier becomes increasingly difficult and time-consuming. The discussion emphasized the importance of interpretation, as different narratives have distinct policy implications. Richard Bräuer points out how the event study tries to defend against this criticism, arguing that, if disruption did not have any relevance, we should not see the differences with the established inventors. However, he also remarks that the model actually accounts for this effect.

Prof. Ottaviano (Bocconi University) followed, inquiring about the possibility to follow inventors in their trajectory (moving from start-ups to more established firms). This is something that can be seen in patent data and some work is already ongoing on this.

Finally, asked about clarification on the measure of disruptiveness, and in particular on the role of patent examiners, the author replies that both firms and examiners are relevant, though it is difficult to account for the re-evaluation process carried by examiners, as it is not available in the dataset.

Paper 8 – 'The Path to Convergence: Reallocation, Responsiveness, and Growth' by Javier Miranda (IWH / FSU)

Presentation

This paper, in collaboration with the World Bank, highlights the importance of business dynamism in resource reallocation and innovation. Institutional frameworks are crucial for efficient resource allocation. Using micro data, the paper explores how firms respond to their environments and the relationship between business dynamism, reallocation, and economic growth.

The theory posits that firms distant from the technological frontier can advance by adopting new technologies and reallocating resources to more productive firms. However, institutional frictions often impede this process.

The paper tests two hypotheses: reallocation decreases with higher GDP per capita, and countries with higher-than-expected reallocation rates grow faster. Findings show greater reallocation in less developed countries and a positive correlation between GDP per capita growth and reallocation.

Data reveal significant cross-country disparities in innovation and responsiveness. CompNet data allows robust cross-country comparisons. Job Creation and Destruction Rates are calculated, with the Job Reallocation Rate being their sum, excluding entry and exit dynamics due to data constraints.

A specification controlling for composition effects and economy-wide shocks estimates 10-year average Adjusted Job Reallocation Rates, showing a positive correlation with Job Reallocation Rates. Eastern European countries exhibit higher reallocation rates, supporting the first hypothesis. There is a positive correlation between Job Reallocation Rates and GDP per capita growth, with Western EU countries showing low values.

Future steps include analyzing the distance to the technology frontier, R&D intensity, competition, access to finance, and democratic institutions to understand knowledge diffusion and its regional implications.

The Discussion by **Eric Bartelsman** points out how this paper establishes CompNet's ability to provide comprehensive industry-level data, enabling high-quality cross-country analyses. Enhanced data coverage and longer time frames make previous findings on production shocks and GDP per capita growth more robust. Linking empirical evidence to theoretical models remains crucial, with recent work highlighting firm dynamics and reallocation drivers, suggesting different regimes for frontier economies.

Q&A

Maarten De Ridder (LSE) praised the paper for its impressive insights using CompNet data. He highlighted the challenge of measuring labor reallocation, noting that significant turnover among personnel can be overlooked even when employment levels appear stable. This aspect of job dynamism is crucial for understanding workforce dynamics but is often missed in traditional job creation and destruction rates.

Lawrence Schembri (Fraser Institute) commended the paper for showcasing the potential of cross-country data in studying reallocation and job dynamism. He suggested that extending country coverage could help assess the robustness of the results beyond Europe.

Gianmarco Cariola (Banca d'Italia) remarked on the relevance of the policy implications of the findings, despite not claiming causality. He questioned whether the results would persist with additional policy measures, noting that higher reallocation rates in Eastern countries might be influenced by less stringent regulatory environments and job dynamism by less restrictive labor unions.

Javier Miranda (IWH) expressed appreciation for his collaboration with Eric on earlier SAS code, emphasizing the ongoing research effort involving various contributors. He agreed on the need for more data, as suggested by Maarten, and proposed that linking firm and employee data would be a logical extension of CompNet. He highlighted the importance of institutional quality, citing regulatory aspects and other indicators discussed in a panel, and suggested exploring their impact on economic outcomes.

Gianmarco Ottaviano (Bocconi University) wondered if participation in the single market could foster convergence, while acknowledging that national characteristics significantly influence outcomes.

Javier Miranda (IWH) further noted that international economic integration plays a crucial role and emphasized the importance of data accessibility. Expanding CompNet globally could provide deeper insights into how diverse institutional frameworks shape economic dynamics.

Carlo Altomonte (Bocconi University) pointed out the importance of entry and exit dynamics, especially among large firms. He suggested that the Micro-Data Infrastructure (MDI) could offer valuable insights by integrating entry and exit dynamics into the analyses, thereby enriching the conclusions.

Session 4 – Climate change, green investment, credit constraints

Paper 9: Lost in Transition: Financial barriers to green growth by Maarten De Ridder (London School of Economics)

Presentation

This paper explores the concept of green growth, focusing on the relationship between innovation and financial constraints. It examines how different levels of pollution can be managed through innovation, particularly green innovations such as nuclear, wind energy, etc. The study presents data showing a rapid increase in green patents from 2000 to 2010, followed by stagnation. The study departs from this fact to study whether green technologies are more sensitive to financial constraints.

The paper introduces a model to investigate if financial constraints impede green innovation and explains such stagnation. Green innovation is lead by younger firms that in turn are more financially constrained than older firms. The model also relies in the assumption that innovation is directed and path-dependent. As the economy transitions towards greener technologies, young firms play a crucial role in green innovation. However, financial crises disproportionately affect these younger firms, thereby slowing down green innovation. Using German data, the study finds that 47% of the slowdown in green innovation can be attributed to financial constraints.

The model incorporates household-based consumption and allows firms to produce goods with either green or dirty inputs, with innovation measured by patents. Firms are assumed to compete à la Bertrand within a Schumpeterian growth model. Firms produce goods whether with clean (Y=Labor) or dirty technology (Y=Labor+ dirty input) within a Cobb -Douglas production function. The marginal cost for producing clean goods is the wage, while for dirty goods, it includes an additional term to be simulated.

Firms choose how much to invest in green and dirty innovation separately. A key assumption is that a firm's past R&D track record influences its current innovation rate, leading to path dependency. Entrants without a track record are more sensitive to incentives and play a critical role in green innovation growth.

The model's optimization involves static and dynamic components. The price set by leading producers depends on costs and markups, with higher innovation leading to higher markups. Dynamic optimization considers the value of obtaining a patent and the number of goods. During economic transitions, higher incentives to innovate green technologies exist, but path dependence makes it difficult for established firms to switch to green tech.

The paper also provide empirical evidence to its model. The strategy relies on different exposure of the firms to the GFC, which impacted the green and dirty patents path. To measure exposure to credit constraints, the authors link firm and bank level data and consider firms linked to the German CommerzBank's (which reduce abruptly credit supply between 2009-2013) as the treatment group.

The study finds that the financial shock led to a 60% decline in green patents, but it did not significantly impact non-green patents. A difference-in-differences-in-differences (DDD) approach reveals that younger firms are primarily responsible for green innovation, and their share decreased post-GFC.
The mechanism of tighter monetary policy, with higher interest rates, impacts younger firms more, consequently affecting green innovation. Structural estimations indicate that financial shocks significantly slow down the green transition by 10%, but do not impact non-green innovation.

The Discussion by **Richard Brauer** briefly summarized the paper, which investigating green growth by examining how financial constraints affect innovation, particularly focusing on green patents. The discussant also highlighted the key findings and in particular the result that younger firms face tighter financial conditions, leading to a greater decline in green patents compared to non-green patents.
The discussant then inquired the author about the empirical and model discrepancies. First, he asked whether the statistical significance of the impact on green vs non-green innovation is strong enough. Then, he suggested focusing on younger firms for the triple interaction analysis and recommended considering other types of innovation to enrich the model. He also highlighted potential issues with patent data, as financial tightness could influence firms' decisions to invest in patents. Finally, he presented some suggestions for model improvement, in particular the incorporation of capital into the model.

Q&A
Reint Gropp (IWH) appreciated the paper, discussing the impact of financial crises on small, green innovating firms, and raised concerns about the side effects of monetary policy on green innovation. The author answered that the results show a diminished role of small firms in green innovation due to the financial crisis, suggesting a need for more supportive policies, not less, to bolster young firms and enhance their capacity for green innovation.
Massimo Giovannini (Central Bank of Malta) questioned the model's handling of financial constraints and asked about large companies acquiring small innovators to circumvent financial challenges. The author pointed out that the banking aspect of the model is simplified, with no new insights there. The market does not fully absorb small innovators, indicating real financial frictions that prevent easy acquisitions, underscoring size-specific financial constraints.
Eleonora Bartoloni (ISTAT) inquired about the representativeness of the sample concerning firm age, size, and sector. Maarten answered that the sample includes firms from 2006 with patent and firm-bank links, limiting representativeness. Similar studies in France show consistent results, though sector differences affect the age composition of innovating firms.
Gianmarco Ottaviano (Bocconi University) asked about the intrinsic qualities of green versus dirty technologies and consumer perceptions. The author responded that the model loads differences on production costs, treating consumer preferences for cleaner products as a cost issue within the model, with dirty production including an externality affecting the total share of polluting goods.
Eric Bartelsman (VU) discussed policy interventions and the impact of financial and monetary shocks on small firms. The author suggested differing collateral requirements by the central bank or fiscal measures targeting young firms, emphasizing the need to address both the environmental externality of dirty innovations and age-specific financial constraints without disproportionately benefiting mature firms.
Lawrence Schembri (Fraser Institute) challenged the focus on bank financing for innovation, highlighting the role of private equity and venture capital during financial crises. The author acknowledged the significant role of bank financing in the study due to the availability of firm-bank links allowing for a difference-in-differences approach, recognizing that capital market data might not provide the same opportunity for this analysis.

Paper 10 – Making the Grass Greener: The Role of Firms' Financial and Managerial Capacity in Paving the Green Transition

Presentation

This study explores how financial constraints and managerial practices affect firms' investments in low-carbon technologies. The presentation, by Guido Franco, discussed the barriers firms face in making green investments and the interaction of these barriers with environmental policies.

The researchers investigated the reasons behind the insufficient investment necessary to achieve zero-emission goals, focusing on whether financial and organizational barriers play a significant role in deterring green investments. They emphasized the importance of financial capacity for such investments, which often face higher risks and require large upfront costs. The study utilized firm-level environmental data from Refinitiv and financial data from Orbis, employing binary and continuous variables to measure green investments and financial constraints. Robustness checks confirmed that financial constraints significantly reduce the likelihood of firms making green investments, and endogeneity concerns were addressed using methods like Difference-in-Differences (DiD) and Instrumental Variables (IV).

The findings revealed that financial constraints notably decrease the likelihood of firms making green investments. To mitigate these financial barriers, the authors suggested enhancing green equity markets, developing secondary markets for green assets, and implementing strong environmental policy signals. A detailed case study on Portugal illustrated how financing constraints impact green investments differently based on technology type and firm size. The study concluded that financial and managerial capacities are crucial for green investments and emphasized the need for targeted policy interventions to support firms in the green transition.

The Discussion, by Marcelo Ribiero, commended the study's policy relevance and suggested that the work could be divided into two papers due to its extensive evidence. He raised concerns about potential selection bias and the exogeneity of firms' debt compositions, advocating for a more robust experimental design to identify causal effects, such as random assignment of green managerial practices. He also recommended exploring the effects of firms' ages on technology adoption and suggested using different statistical models to handle the data's characteristics better. Ribiero emphasized the need for a deeper discussion on the economic mechanisms and policy implications to refine the study's conclusions.

Q&A

Alain Durré (France Strategie) asked how missing variables such as the discount factor, the myopia of firms, and expectations of energy prices, particularly electricity, influence the results regarding the profitability of green investments. The author answered that these missing variables were addressed using a difference-in-differences approach. They assumed that firms within the same sectors encounter similar energy prices and conditions, acknowledging some degree of heterogeneity.

Massimiliano Pisani (Banca d'Italia) inquired about the interaction between financial constraints and carbon taxes, and how this combination could potentially lead firms to increase brown investments due to the anticipation of high carbon taxes. The author explained that even though large firms are generally less financially constrained, green investments tend to be disproportionately affected when financial constraints are present. This interaction might indeed create perverse incentives for firms to favor brown investments under stringent carbon tax conditions.

Carlo Altomonte (Bocconi University) questioned why large firms, which should theoretically have better access to finances, still experience a decline in green investments when environmental regulations become stricter. The author responded that the drop in green investments among large firms, despite having access to finances, indicates that stricter environmental conditions can negatively affect the average returns on these investments. This phenomenon suggests a different but complementary channel affecting investment decisions and indicates that size-based policies might be necessary to alleviate the burden on SMEs.