RoME: Firms and Innovation

Academic Year 2025–2026

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1 Course Overview

This course explores two seminal and closely interrelated topics in macroeconomics: firm dynamics and innovation. We will study key models and empirical facts related to firm entry and exit, the distribution of firm size and age, and firm growth. We will then examine a key driver of such dynamics: innovation. Throughout, we pay special attention to how the decisions of innovative firms shape economic growth.

2 Logistics

- **Schedule:** Three 90-minute classes per week (two lectures and one assignment review session). The assignment review sessions will also be an opportunity to work on the numerical solution of the models we study in the lectures.
- **Grading:** Problem sets (30%) + Participation (10%) + final exam (60%).
  - *Problem sets*: Students may work individually or in pairs. In the latter case, please indicate your coauthor. Each student must submit their own copy by email. Please use "RoME Firms and Innovation: Pset - - submission" as the subject of your email (replace - - with the problem set number). Please double-check your submission files, as incorrect files will not count as a valid submission. Late submissions within 24 hours of the deadline will incur a 50% penalty. After 24 hours, submissions will no longer be accepted. Exceptions may apply only in cases of extenuating circumstances, such as family or medical emergencies.
  - *Participation*: Students are encouraged to actively participate during classes, especially during the assignment review sessions on Fridays. In these sessions, students may be asked to go to the board to discuss how to solve problems, present their derivations, and work through solutions with the class.
  - *Exam*: individual and closed-book; will take place between March 16th-25th.
- **Location:** Via Abruzzi 10, in the (raised) ground-floor classroom.
- **Office Hours:** By appointment.

3 Course Schedule

Table 1: Class-by-class schedule (tentative)

Date & time	Session	Topic
Fri, Jan 16 (16:30–18:00)	Lecture 1	Introduction; firm dynamics (stylized facts)
Mon, Jan 19 (11:00–12:30)	Lecture 2	Firm dynamics: Hopenhayn model; optimal stopping (exit) theory
Wed, Jan 21 (11:00–12:30)	Lecture 3	Firm dynamics: Hopenhayn model; optimal stopping (exit) theory
Fri, Jan 23 (14:45–16:15)	Review / numerics	Problem Set #1 discussion
Mon, Jan 26 (11:00–12:30)	Lecture 4	Firm dynamics: Melitz model; Luttmer model
Wed, Jan 28 (11:00)	**PSet #1 Due Date**	Submit by email no later than 11:00
Wed, Jan 28 (11:00–12:30)	Lecture 5	Firm dynamics: Melitz model; Luttmer model
Fri, Jan 30 (14:45–16:15)	Review / numerics	Problem Set #2 discussion
Mon, Feb 2 (11:00–12:30)	Lecture 6	Innovation and innovative firms (stylized facts)
Wed, Feb 4 (11:00–12:30)	Lecture 7	Innovation and firm dynamics: the Klette–Kortum model
Mon, Feb 9 (11:00–12:30)	Lecture 8	Innovation and firm dynamics: the Klette–Kortum model (continued)
Wed, Feb 11 (11:00–12:30)	Lecture 9	Klette–Kortum: recent developments
Fri, Feb 13 (14:45)	**PSet #2 Due Date**	Submit by email no later than 14:45

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Date & time	Session	Topic
Fri, Feb 13 (14:45–16:15)	Review / numerics	Problem Set #3 discussion
Mon, Feb 16 (11:00–12:30)	Lecture 10	Klette–Kortum: recent developments (continued)
Wed, Feb 18 (11:00–12:30)	Lecture 11	Step-by-step innovation models
Fri, Feb 20 (14:45)	**PSet #3 Due Date**	Submit by email no later than 14:45
Fri, Feb 20 (14:45–16:15)	Review / numerics	Problem Set #4 discussion
Mon, Feb 23 (11:00–12:30)	Lecture 12	Application: green technology transition and innovation (to be confirmed)
Wed, Feb 25 (11:00–12:30)	Lecture 13	Application: development, institutions, and trade (to be confirmed)
Fri, Feb 27 (14:45)	**PSet #4 Due Date**	Submit by email no later than 14:45
Fri, Feb 27 (14:45–16:15)	Conclusion	More applications; open questions; exam guidance (to be confirmed)

4 Topics

4.1 Firm Dynamics: stylized facts and models

This part of the course covers key stylized facts and foundational models of firm dynamics. In this process, we will also learn analytical and numerical techniques used to solve models with fixed costs and endogenous exit.

References (references marked with $*$ denote core readings) Hopenhayn (1992)*; Melitz (2003)*; Luttmer (2007); Stokey (2009, Ch. 6); Jovanovic (1982); Lucas (1978); Atkeson and Kehoe (2005); Boehm, Oberfield, and Waseem (2024); Haltiwanger, Jarmin, and Miranda (2012); Chen (2023); Ayerst, Nguyen, and Restuccia (2025).

4.2 Innovation as a driver of firms' productivity dynamics

We will study the economics of ideas and innovation and their role in shaping firm dynamics. We will cover key stylized facts on innovative firms and examine the patent system, its limitations, and recent measures developed to quantify innovation using patent data.

References Griliches (1957, 1987, 1990, 1998); Cohen (2010); Kogan, Papanikolaou, Seru and Stoffman (2017); Bloom, Schankerman and John Van Reenen. (2013); Akcigit and Kerr (2018); Ewens and Marx (2024); Marx and Fuegi (2020, 2022). Kelly, Papanikolaou, Seru, and Taddy (2021). Arts, Hou, and Gomez (2021), Kalyani (2024); Romer (1990); Aghion and Howitt (1992); Grossman and Helpman (1991); Jones (1995, 2005, 2019); Acemoglu (2009).

4.3 Modeling Innovative Firms: the Klette and Kortum Model and Recent Developments

This part of the course connects the previous two topics by bringing models of firm dynamics to data on innovative firms. We focus on the Klette and Kortum (2004) model as a central framework for studying innovation-driven firm growth and aggregate outcomes using micro-level evidence. We then examine a set of influential recent contributions that shed new light—both empirically and theoretically—on the dynamics of innovative firms.

References Klette and Kortum (2004)*; Aghion, Akcigit and Howitt (2014)*; Akcigit (2023); Akcigit and Kerr (2018); Berlingieri, De Ridder, Lashkari and Rigo (2024); Peters (2020).

4.4 Step-by-Step Innovation Models

This part of the course extends the models studied in the previous topic by relaxing the assumption that entrants and incumbents can innovate and immediately catch up with the technological frontier. Instead, innovation is modeled as a step-by-step process, in which firms advance through successive quality improvements. To catch up with the frontier—or to continue pushing it forward—firms may need to undertake multiple innovation steps over time. This framework allows the models to connect more closely to strategic competition, firm heterogeneity, and innovation decisions observed in the data.

References Aghion, Harris, Howitt and Vickers (2001)*; Aghion, Akcigit and Howitt (2014)*; Aghion, Harris and Vickers (1997); Acemoglu (2009, Section 14.4); Aghion, Bloom, Blundell, Griffith and Howitt (2005).

4.5 Applications

In this final session, we study (time permitting) a wide range of applications of the key models and tools developed in the previous topics. The applications include the transition to green technologies, international trade, development and institutions, among others.

References Acemoglu, Akcigit, Hanley, and Kerr (2016); Akcigit, Ates and Impullitti (2023); Atkeson and Burstein (2010); Melitz and Redding (2023); Peters and Zilibotti (2023); Choi and Shim (2024); Akcigit, Alp and Peters (2021); Akcigit, Baslandze and Lotti (2023); Akcigit and Van Reenen (2023).

5 References

[1] Acemoglu, Daron. 2009. "Introduction to Modern Economic Growth." Princeton, NJ: Princeton University Press.

[2] Acemoglu, Daron, Ufuk Akcigit, Douglas Hanley, and William Kerr. 2016. "Transition to Clean Technology." Journal of Political Economy 124 (1): 52–104.

[3] Aghion, Philippe, and Peter Howitt. 1992. "A Model of Growth Through Creative Destruction." *Econometrica* 60 (2): 323–51.

[4] Aghion, Philippe, Christopher Harris, and John Vickers. 1997. "Competition and Growth with Step-by-Step Innovation: An Example." *European Economic Review* 41 (3): 771-82.

[5] Aghion, Philippe, Christopher Harris, Peter Howitt, and John Vickers. 2001. "Competition, Imitation and Growth with Step-by-Step Innovation." *Review of Economic Studies* 68 (3): 467–92.

[6] Aghion, Philippe, Nick Bloom, Richard Blundell, Rachel Griffith, and Peter Howitt. 2005. "Competition and Innovation: An Inverted-U Relationship." *Quarterly Journal of Economics* 120 (2): 701–28.

[7] Aghion, Philippe, Ufuk Akcigit, and Peter Howitt. 2014. "What Do We Learn From Schumpeterian Growth Theory?" In *Handbook of Economic Growth*, vol. 2, edited by Philippe Aghion and Steven N. Durlauf, 515-63. Elsevier.

[8] Aghion, Philippe, Antonin Bergeaud, Timo Boppart, Peter J. Klenow, and Huiyu Li. 2023. "A Theory of Falling Growth and Rising Rents." *Review of Economic Studies* 90 (6): 2675–2702. https://doi.org/10.1093/restud/rdad016.

[9] Akcigit, Ufuk. 2023. "Creative Destruction and Economic Growth" In *Economics of Creative Destruction: New Research on Themes from Aghion and Howitt*, edited by Ufuk Akcigit and John Van Reenen, 21-39. Cambridge, MA: Harvard University Press.

[10] Akcigit, Ufuk, and William R. Kerr. 2018. "Growth through Heterogeneous Innovations." *Journal of Political Economy* 126 (4): 1374-1443.

[11] Akcigit, Ufuk, Harun Alp, and Michael Peters. 2021. "Lack of Selection and Limits to Delegation: Firm Dynamics in Developing Countries." *American Economic Review* 111 (1): 231–75.

[12] Akcigit, Ufuk, and Sina T. Ates. 2023. "What Happened to US Business Dynamism?" *Journal of Political Economy* 131 (8): 2059-2124.

[13] Akcigit, Ufuk, and John Van Reenen, eds. 2023. *Economics of Creative Destruction: New Research on Themes from Aghion and Howitt.* Cambridge, MA: Harvard University Press.

[14] Akcigit, Ufuk, Sina Ates, and Giammario Impullitti. 2023. "Innovation and Trade Policy in a Globalized World." Journal of Political Economy: Macroeconomics (forthcoming).

[15] Akcigit, Ufuk, Salomé Baslandze, and Francesca Lotti. 2023. "Connecting to Power: Political Connections, Innovation, and Firm Dynamics." *Econometrica* 91 (2): 529-64. https://doi.org/10.3982/ECTA18338.

[16] Arts, Sam, Jianan Hou, and Juan Carlos Gomez. 2021. "Natural Language Processing to Identify the Creation and Impact of New Technologies in Patent Text." Research Policy 50 (2).

[17] Atkeson, Andrew, and Ariel Burstein. 2010. "Innovation, Firm Dynamics, and International Trade." *Journal of Political Economy* 118 (3): 433–84.

[18] Atkeson, Andrew, and Patrick J. Kehoe. 2005. "Modeling and Measuring Organization Capital." Journal of Political Economy 113(5): 1026–53. https://doi.org/10.1086/431289.

[19] Ayerst, Stephen, Duc M. Nguyen, and Diego Restuccia. 2025. "The Micro and Macro Productivity of Nations." Working Paper 32750. Cambridge, MA: National Bureau of Economic Research.

[20] Berlingieri, Giuseppe, Maarten De Ridder, Danial Lashkari, and Davide Rigo. 2025. "Creative Destruction through Innovation Bursts." Working paper.

[21] Bloom, Nicholas, Mark Schankerman, and John Van Reenen. 2013. "Identifying Technology Spillovers and Product Market Rivalry." *Econometrica* 81 (4): 1347-93. https://doi.org/10.3982/ECTA9466.

[22] Bloom, Nicholas, Charles I. Jones, John Van Reenen, and Michael Webb. 2020. "Are Ideas Getting Harder to Find?" *American Economic Review* 110 (4): 1104–44.

[23] Boehm, Johannes, Ezra Oberfield, Ruairidh South, and Mazhar Waseem. 2024. "The Network Origins of Firm Dynamics: Contracting Frictions and Dynamism with Long-Term Relationships." Working Paper.

[24] Chen, Zhang. 2023. "Economic Growth and the Rise of Large Firms." Working Paper, Hong Kong University of Science and Technology.

[25] Choi, Jaedo, and Younghun Shim. 2024. "From Adoption to Innovation: State-Dependent Technology Policy in Developing Countries." Working paper.

[26] Cohen, Wesley M. 2010. "Fifty Years of Empirical Studies of Innovative Activity and Performance." In *Handbook of the Economics of Innovation*, vol. 1, edited by Bronwyn H. Hall and Nathan Rosenberg, 129-213. North-Holland. https://doi.org/10.1016/S0169-7218(10)01004-X.

[27] Eaton, Jonathan, and Samuel Kortum. 2024. "Technology and the Global Economy." *Annual Review of Economics* 16: 79-104. https://doi.org/10.1146/annurev-economics-080218-025541.

[28] Ewens, Michael, and Matt Marx. 2024. "Firm Age and Invention: An Open-Access Dataset." Working Paper.

[29] Garcia-Macia, Daniel, Chang-Tai Hsieh, and Peter J. Klenow. 2019. "How Destructive Is Innovation?" *Econometrica* 87 (5): 1507-41. https://doi.org/10.3982/ECTA14930.

[30] Grossman, Gene M., and Elhanan Helpman. 1991. *Innovation and Growth in the World Economy*. Cambridge, MA: MIT Press.

[31] Griliches, Zvi. 1957. "Hybrid Corn: An Exploration in the Economics of Technological Change." *Econometrica* 25 (4): 501–22. https://doi.org/10.2307/1905380.

[32] Griliches, Z. 1987. "R&D and Productivity: Measurement Issues and Econometric Results." Science, 237(4810), 31–35. http://www.jstor.org/stable/1699597l.

[33] Griliches, Zvi. 1990. "Patent Statistics as Economic Indicators: A Survey." *Journal of Economic Literature* 28 (4): 1661–1707.

[34] Griliches, Zvi. 1998. *R&D and Productivity: The Econometric Evidence*. Chicago: University of Chicago Press.

[35] Haltiwanger, John C., Ron S. Jarmin, and Javier Miranda. 2012. "Who Creates Jobs? Small vs. Large vs. Young." Working Paper No. 16300. Cambridge, MA: National Bureau of Economic Research.

[36] Hopenhayn, Hugo A. 1992. "Entry, Exit, and Firm Dynamics in Long Run Equilibrium." *Econometrica* 60 (5): 1127–50. https://doi.org/10.2307/2951541.

[37] Jones, Charles I. 1995. "R & D-Based Models of Economic Growth." Journal of Political Economy 103 (4): 759–784.

[38] Jones, Charles I. 2005. "Growth and Ideas." In Handbook of Economic Growth, vol. 1B, edited by Philippe Aghion and Steven N. Durlauf, chap. 16. Amsterdam: Elsevier.

[39] Jones, Charles I. 2019. "Paul Romer: Ideas, Nonrivalry, and Endogenous Growth." Scand. J. of Economics, 121: 859-883. https://doi.org/10.1111/sjoe.12370

[40] Jovanovic, Boyan. 1982. "Selection and the Evolution of Industry." *Econometrica* 50 (3): 649–70. https://doi.org/10.2307/1912606.

[41] Kalyani, Aakash. 2024. "The Creativity Decline: Evidence from US Patents." Available at SSRN: https://ssrn.com/abstract=4318158 or http://dx.doi.org/10.2139/ssrn.4318158

[42] Kelly, Bryan, Dimitris Papanikolaou, Amit Seru, and Matt Taddy. 2021. "Measuring Technological Innovation over the Long Run." American Economic Review: Insights 3 (3): 303–20.

[43] Klette, Tor Jakob, and Samuel Kortum. 2004. "Innovating Firms and Aggregate Innovation." *Journal of Political Economy* 112 (5): 986-1018.

[44] Kogan, Leonid, Dimitris Papanikolaou, Amit Seru, and Noah Stoffman. 2017. "Technological Innovation, Resource Allocation, and Growth." *Quarterly Journal of Economics* 132 (2): 665–712. https://doi.org/10.1093/qje/qjw040.

[45] Lucas, Robert E. 1978. "On the Size Distribution of Business Firms." *Bell Journal of Economics* 9 (2): 508–23. https://doi.org/10.2307/3003596.

[46] Luttmer, Erzo. 2007. "Selection, Growth, and the Size Distribution of Firms." *Quarterly Journal of Economics* 122 (3): 1103-44.

[47] Luttmer, Erzo. 2010. "Models of Growth and Firm Heterogeneity." *Annual Review of Economics* 2: 547-76.

[48] Marx, Matt and Aaron Fuegi. 2022. "Reliance on Science by Inventors: Hybrid Extraction of In-Text Patent-to-Article Citations." Journal of Economics & Management Strategy, 31, 369–392.

[49] Marx M, Fuegi A. "Reliance on science: Worldwide front-page patent citations to scientific articles." Strat. Mgmt. J. 2020; 41: 1572–1594. https://doi.org/10.1002/smj.3145

[50] Melitz, Marc J. 2003. "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity." *Econometrica* 71 (6): 1695-1725.

[51] Melitz, Marc J., and Stephen J. Redding. 2023. "Trade and Innovation." In *Economics of Creative Destruction: New Research on Themes from Aghion and Howitt*, edited by Ufuk Akcigit and John Van Reenen, 133-171. Cambridge, MA: Harvard University Press.

[52] Peters, Michael. 2020. "Heterogeneous Markups, Growth, and Endogenous Misallocation." *Econometrica* 88 (5): 2037-2073. https://doi.org/10.3982/ECTA15565.

[53] Peters, Michael, and Conor Walsh. 2024. "Population Growth and Firm-Product Dynamics." Working paper.

[54] Peters, Michael, and Fabrizio Zilibotti. 2023. "Creative Destruction, Distance to Frontier, and Economic Development." In *Economics of Creative Destruction: New Research on Themes from Aghion and Howitt*, edited by Ufuk Akcigit and John Van Reenen, 475-519. Cambridge, MA: Harvard University Press.

[55] Romer, Paul M. 1990. "Endogenous Technological Change." *Journal of Political Economy* 98 (5, pt. 2): S71–102. http://www.jstor.org/stable/2937632.

[56] Stokey, Nancy L. 2009. "The Economics of Inaction: Stochastic Control Models with Fixed Costs." Princeton University Press. http://www.jstor.org/stable/j.ctt7sfgq.