

Jonathan Swarbrick – Presentation

The Department of Economics and Related Studies
University of York

30th January 2020

1. Research to date
2. Current paper – Business Cycles in Space
3. Early stage projects
4. Research agenda and contribution to the Department

Research to date

PhD thesis focused on macro-financial linkages:

- ▶ Credit crunches from occasionally binding bank borrowing constraints
with Paul Levine (Surrey) and Tom Holden (Bundesbank)
Forthcoming: Journal of Money, Credit and Banking
- ▶ Lending standards, productivity and credit crunches
Under review at Journal of Economic Dynamics and Control
- ▶ Monetary policy and cross-border interbank market fragmentation: lessons from the crisis
with Tobias Blattner (ECB)
Re-submitted at BE Journal of Macroeconomics

Other completed research

- ▶ Reconciling Jaimovich-Rebelo Preferences, Habit in Consumption and Labor Supply
with Paul Levine and Tom Holden
Published in Economic Letters (2018)

Business cycles in space

Joint with Tom Holden (Bundesbank)

We're interested in spatial organization of economic activity and how this varies over the business cycle.

- ▶ Macro literature usually abstracts from within-country geography.

Business cycles in space

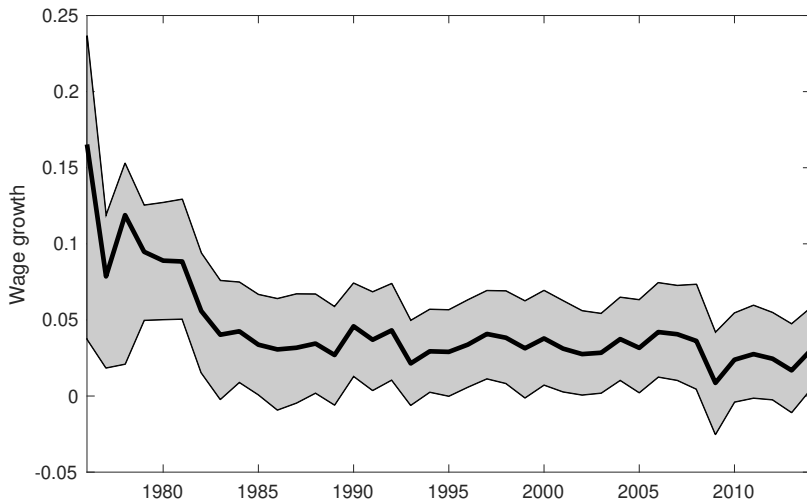


Figure: US county-level wage growth: mean & 10th/90th percentiles (BLS, unweighted)

Business cycles in space

Joint with Tom Holden (Bundesbank)

We're interested in spatial organization of economic activity and how this varies over the business cycle.

- ▶ Macro literature usually abstracts from within-country geography.
- ▶ New economic geography literature usually studies long-run and transition paths, not business cycles.
 - ▶ Existing dynamic models usually either finite locations, purely backward-looking, or very restrictive assumptions (no migration/capital relocation, perfect-foresight etc)

▶ New Economic Geography Literature

Business cycles in space – contributions

1. We propose a framework to model continuous-in-space heterogeneity
 - ▶ Attributes and shocks which drive heterogeneity are correlated across space.
 - ▶ Space need not be physical space
 - ▶ The geometry of space is flexible

Business cycles in space – contributions

1. We propose a framework to model continuous-in-space heterogeneity
 - ▶ Attributes and shocks which drive heterogeneity are correlated across space.
 - ▶ Space need not be physical space
 - ▶ The geometry of space is flexible
2. As a benchmark case, we develop a DSGE model of economic geography.
 - ▶ Real business cycle model + firm dynamics + typical ingredients from NEG model
 - ▶ Currently treated as story-telling device, capturing dynamics of economic geography in the U.S.
 - ▶ Agglomeration forces will lead to persistent movements in population and capital
 - ▶ Exploring short-medium frequency cycles

General framework

1. Define the geometry of the relevant space: plane, circle, torus, network, etc.
 - ▶ E.g., suppose space is a square plane, indexed by $x \in X$.

General framework

1. Define the geometry of the relevant space: plane, circle, torus, network, etc.
 - ▶ E.g., suppose space is a square plane, indexed by $x \in X$.
2. Define the model: objectives, markets, frictions and spatial shock(s).
 - ▶ There will be conditions at each location x giving decisions and state evolution.
 - ▶ There will be some aggregate / market conditions.
 - ▶ Covariance of spatial shocks between locations will be a function of the distance between them.

General framework

1. Define the geometry of the relevant space: plane, circle, torus, network, etc.
 - ▶ E.g., suppose space is a square plane, indexed by $x \in X$.
2. Define the model: objectives, markets, frictions and spatial shock(s).
 - ▶ There will be conditions at each location x giving decisions and state evolution.
 - ▶ There will be some aggregate / market conditions.
 - ▶ Covariance of spatial shocks between locations will be a function of the distance between them.
3. Choose grid geometry, e.g. $N = 100$ evenly spaced points on 10×10 square grid.
 - ▶ Approximate outcomes at locations between nodes via linear interpolation.
 - ▶ Approximate integrals over space via the trapezium rule.
 - ▶ E.g. market clearing conditions of the form: $0 = \int_0^1 B_{x,t} dx$ become
$$0 = \sum_{n=1}^N B_{x_n,t}.$$

General framework

1. Define the geometry of the relevant space: plane, circle, torus, network, etc.
 - ▶ E.g., suppose space is a square plane, indexed by $x \in X$.
2. Define the model: objectives, markets, frictions and spatial shock(s).
 - ▶ There will be conditions at each location x giving decisions and state evolution.
 - ▶ There will be some aggregate / market conditions.
 - ▶ Covariance of spatial shocks between locations will be a function of the distance between them.
3. Choose grid geometry, e.g. $N = 100$ evenly spaced points on 10×10 square grid.
 - ▶ Approximate outcomes at locations between nodes via linear interpolation.
 - ▶ Approximate integrals over space via the trapezium rule.
 - ▶ E.g. market clearing conditions of the form: $0 = \int_0^1 B_{x,t} dx$ become $0 = \sum_{n=1}^N B_{x_n,t}$.
4. Solve via perturbation. e.g., with Dynare.
 - ▶ We provide a toolkit to help define spatially correlated shocks:
<https://github.com/tholden/DynareTransformationEngine>

Model details

RBC model + standard new economic geography features (following [Krugman 1991](#))

Includes:

- ▶ Population movement.
- ▶ Competing land usage: farming and residential.
- ▶ Non-tradeable raw goods (production services).
- ▶ Two types of final good: agricultural products and manufactured products.
- ▶ Differentiated intermediate manufactured goods subject to iceberg trade costs.
- ▶ Firm entry à la [Bilbiie, Ghironi & Melitz \(2012\)](#).

▶ Agglomeration Mechanism

▶ Numerical Strategy

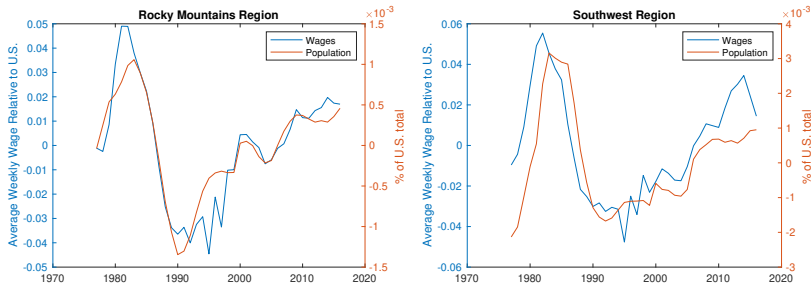
Next steps 1/2

1. Currently doing some work to estimate causal linkages between wages–population
 - ▶ VAR with U.S. county-level wages, population and instrument for population (total population divided by distance to coast – justification: immigration traditionally gone to coasts.)
2. Use our model to identify why wage–population correlation breaks down.

▶ More info

Next steps 2/2

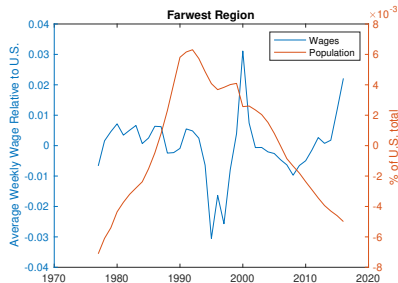
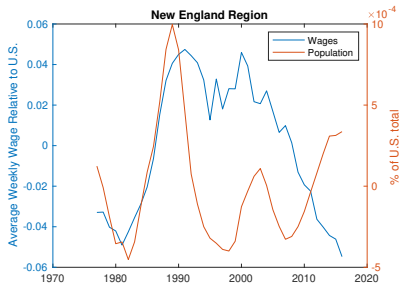
- E.g., consider some U.S. regions:



Note: plots show deviation of relative wage and population around linear trends

Next steps 2/2

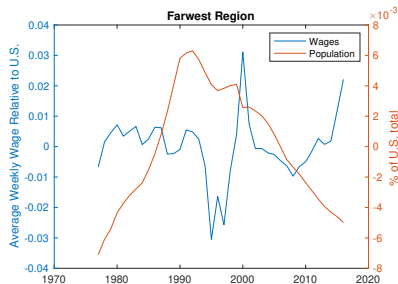
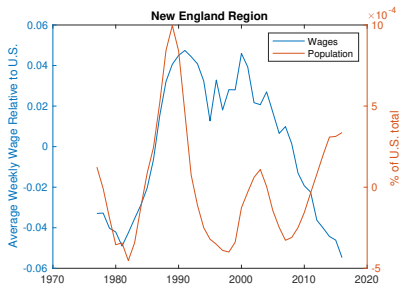
- E.g., consider some U.S. regions:
... and some other regions:



Note: plots show deviation of relative wage and population around linear trends

Next steps 2/2

- ▶ E.g., consider some U.S. regions:
... and some other regions:



Note: plots show deviation of relative wage and population around linear trends

- ▶ We plan to use the model to identify the source of the difference.
 - ▶ Land use regulation? Technology changes?
 - ▶ Any policy implications?

Other early stage projects

1. Hours and wages *with Cristiano Cantore (BoE)*

- ▶ Standard macro model does a poor job explaining *individual* labour supply decisions.
- ▶ Non-linear relationship between wages and labour supply in cross-sectional data, and through the lens of the model, it is difficult to explain why higher wage workers work so much.
- ▶ We're asking:
 - a) What factors are responsible for explaining the cross-sectional evidence?
 - b) How do these vary over the business cycle?
 - c) Can they help understand the cyclical properties of aggregate labour supply?

Other early stage projects

2. Limited Asset Market Participation and Monetary Policy in a Small Open Economy

with Paul Levine (Surrey), Stephen McKnight (El Colegio de México) and Alex Mihailov (Reading)

- ▶ We study optimal policy in a small-open economy with rule-of-thumb households
- ▶ Builds on a result in Bilbiie (2008, JET) that the effect of monetary policy on aggregate demand can reverse with limited asset-market participation
- ▶ We show that in an open economy context, degree of openness effects the result.
 - ▶ The more open the economy, the less likely inversion becomes

Other early stage projects

3. Imperfect Exchange Rate Pass-through: Empirical Evidence and Monetary Policy Implications

with Paul Levine, Vasco Gabriel and Maryam Mirfatah (all Surrey)

- ▶ Estimating models with alternative pricing regimes (dominant-currency, producer-currency, local-currency)
- ▶ Plan to perform a likelihood race and study the implications for optimized monetary policy rules

4. Macro-prudential policy games with financial frictions

with Kemal Ozhan (BoC)

- ▶ Very early stages
 - ▶ Want to study the role of macro-prudential policy games within the context of the global financial cycle
 - ▶ We particularly want to think about the transmission of risk

Future Research 1/2

My research agenda includes broad focus across macroeconomics, with particular interest in themes:

- ▶ Monetary, macro and open-economy
 - ▶ Projects with Paul Levine
 - ▶ Policy research on monetary policy regimes
 - ▶ Links to other work in department (e.g., by Neil Rankin, Paulo Santos Monteiro, Michael Wickens, Subir Chattopadhyay)
- ▶ Studying macro-financial linkages in closed and open economy models
 - ▶ I plan to study firm finance dynamics and employment
 - ▶ Work in this area would contribute to the Centre for Applied Macro-Finance
 - ▶ Compliments the department's applied macro-finance research (e.g., by Laura Coroneo, Adam Golinski, Michael Wickens)

Future Research 2/2

- ▶ Link between micro data and macro models, for example:
 - ▶ Building on work with Tom Holden on models of continuous heterogeneity
 - ▶ Work with Cristiano using panel data to think about aggregate modeling
 - ▶ Work in this area will contribute to the work in the Centre for Panel Data Analysis.
 - ▶ Work on macro-labour links to department research (e.g., by Joao Madeira)
- ▶ Economic geography
 - ▶ Bridging the macroeconomic and spatial economic literatures.
 - ▶ Spatial economics is a growing field with new data becoming available
 - ▶ Connects with work of others in the department (PanDA, Thilo Huning)

Supporting Research

To contribute to the research aims of the department:

- ▶ I would bring a growing research network:
 - ▶ With central banks and policy institutions that can contribute to the impact factor:
 - ▶ Several projects with central bank researchers on policy-relevant areas
 - ▶ Current policy work taking a lead on a monetary policy regime horserace exercise, connecting with BIS, Fed, ECB, BdE, BoJ
 - ▶ Contribution to the Macroeconomics Summer School at Surrey
 - ▶ Gives opportunity to connect with and teach Ph.D. students and early career researchers
- ▶ In my first year, I plan to apply for grants to support my research projects:
 - ▶ Leverhulme research project grant
 - ▶ ESRC research project grant

I will keep tabs on other open calls (e.g., ESRC, EC, Royal Society, British Academy) and seek to collaborate in existing network on funding opportunities.

Appendices

Wage growth distribution

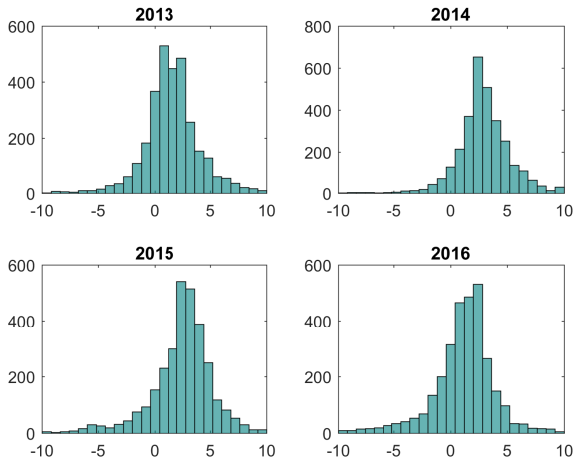


Figure: US county-level average weekly wage oty % change (BLS)

Wage growth dispersion

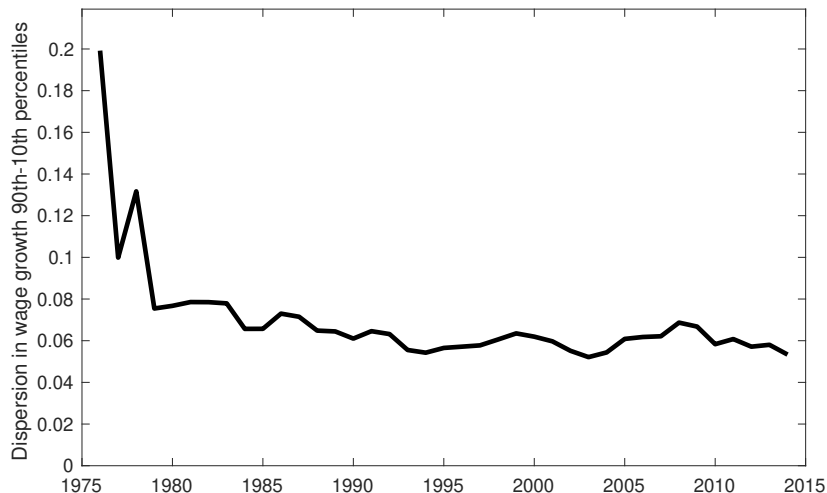


Figure: US county-level wage growth dispersion: 90th-10th percentiles (BLS, unweighted)

New economic geography

Starts with [Krugman \(1991\)](#). See [Krugman \(1998\)](#) and [Redding \(2013\)](#) for reviews.

Branches of the existing literature:

- ▶ Stochastic, forward-looking, but few locations, e.g., two-bloc model:
 - ▶ E.g., [Caselli & Coleman II \(2001\)](#).
- ▶ Stationary equilibria, or purely backward looking decisions, with discrete space:
 - ▶ E.g., [Michaels, Rauch & Redding \(2012\)](#), [Nagy \(2016\)](#) and [Eckert & Peters \(2017\)](#).
- ▶ Continuous space, dynamic but backward-looking:
 - ▶ E.g., [Desmet & Rossi-Hansberg \(2014\)](#) and [Desmet, Nagy & Rossi-Hansberg \(2015\)](#).
- ▶ Some dynamic stochastic models in continuous space but with restrictive assumptions:
 - ▶ E.g., [Quah \(2002\)](#), [Brito \(2004\)](#), [Duranton \(2007\)](#), [Rossi-Hansberg & Wright \(2007\)](#) and [Boucekkine, Camacho & Zou \(2009\)](#).

Agglomeration mechanism

The key mechanism works as follows:

- ▶ Productivity shock at x increases wages there.
- ▶ People move to x for higher wages.
- ▶ The increased demand leads to firm entry.
- ▶ More products on sale implies increased productivity due to the taste for variety.
- ▶ This feeds back to higher wages, more migration, more firm entry etc.
- ▶ Nearby locations also benefit as iceberg transport costs mean the increased demand from x is concentrated in its neighbourhood.

▶ Return

Numerical Strategy

1. Calibration – ratios and ergodic moments
 - ▶ Discipline spatially correlated shock using county-level wage data: estimate AR(1) model with county and year fixed effects. Compute between-location correlation of residuals
2. Simulation exercises, study propagation of local shocks and aggregate shocks
 - ▶ We find extremely persistent effects of spatial shocks – this stems from agglomeration mechanism
3. Further empirical exercises (to do!)
 - ▶ Identify source of breakdown between wage - population correlation
4. Normative exercises (to do!)
 - ▶ Are there place-based policies that improve outcomes?
 - ▶ Depends on answer to (3) – e.g., there a likely different implications of whether land-use regulation is key to wage and population dynamics, or whether changing technology is more important

1. Instrument for county level population as follows: county by county, total US population (log level) divided by measure of the distance of the county to the nearest coast. Justification of the instrument: immigration has traditionally gone to coasts.
2. County by county, linearly detrend: a) the instrument, b) county level (log level) population and c) county level (log level) wages.
3. For each time period, subtract the mean across counties of each of the three variables (detrended population, detrended wages, detrended instrument) from that variable. (So after this each variable has zero mean both across time and across counties.

4. Call demeaned detrended population x_t , demeaned detrended wages y_t and the demeaned detrended instrument z_t . In each county, we have the following three equations, where in all cases \cdots covers a sum of lags of x_t , y_t and z_t :

$$x_t = a_{xy}y_t + \cdots + \epsilon_{x,t} \quad (1)$$

$$y_t = a_{yx}x_t + \cdots + \epsilon_{y,t} \quad (2)$$

$$z_t = \cdots + \beta\epsilon_{x,t} + \epsilon_{z,t} \quad (3)$$

where the structural shocks are uncorrelated. Thus:

$$z_t - \beta x_t + \beta a_{xy}y_t = \cdots + \epsilon_{z,t} \quad (4)$$

So:

$$\begin{bmatrix} 1 & -a_{xy} & 0 \\ a_{yx} & 1 & 0 \\ -\beta & \beta a_{xy} & 1 \end{bmatrix} \begin{bmatrix} x_t \\ y_t \\ z_t \end{bmatrix} = \cdots + \begin{bmatrix} \epsilon_{x,t} \\ \epsilon_{y,t} \\ \epsilon_{z,t} \end{bmatrix} \quad (5)$$

5. Estimate this three variable VAR using data pooled across counties (i.e. assuming all parameters are identical in all counties).

References I

- Bilbiie, F. O., Ghironi, F. & Melitz, M. J. (2012), 'Endogenous Entry, Product Variety, and Business Cycles', *Journal of Political Economy* **120**(2), 304–345.
- Boucekkine, R., Camacho, C. & Zou, B. (2009), 'Bridging The Gap Between Growth Theory And The New Economic Geography: The Spatial Ramsey Model', *Macroeconomic Dynamics* **13**(01), 20–45.
- Brito, P. (2004), The Dynamics of Growth and Distribution in a Spatially Heterogeneous World, Working Papers Department of Economics 2004/14, ISEG - Lisbon School of Economics and Management, Department of Economics, Universidade de Lisboa.
- Caselli, F. & Coleman II, W. J. (2001), 'The u.s. structural transformation and regional convergence: A reinterpretation', *Journal of Political Economy* **109**(3), 584–616.
- Desmet, K., Nagy, D. & Rossi-Hansberg, E. (2015), 'The geography of development: Evaluating migration restrictions and coastal flooding'.
- Desmet, K. & Rossi-Hansberg, E. (2014), 'Spatial development', **104**(4), 1211–43.

References II

- Duranton, G. (2007), 'Urban Evolutions: The Fast, the Slow, and the Still', *American Economic Review* **97**(1), 197–221.
- Eckert, F. & Peters, M. (2017), 'Spatial structural change and agricultural productivity'.
- Krugman, P. (1991), 'Increasing Returns and Economic Geography', *Journal of Political Economy* **99**(3), 483–499.
- Krugman, P. (1998), 'What's new about the new economic geography?', *Oxford Review of Economic Policy* **14**(2), 7–17.
- Michaels, G., Rauch, F. & Redding, S. J. (2012), 'Urbanization and Structural Transformation', *The Quarterly Journal of Economics* **127**(2), 535–586.
- Nagy, D. (2016), 'City location and economic development'.
- Quah, D. (2002), 'Spatial Agglomeration Dynamics', *American Economic Review* **92**(2), 247–252.
- Redding, S. J. (2013), Economic Geography: A Review of the Theoretical and Empirical Literature, in R. E. Falvey, D. Greenaway, U. Kreickemeier & D. Bernhofen, eds, 'Palgrave handbook of international trade', 1 edn, Palgrave Macmillan UK, chapter 16, pp. 497–531.

References III

Rossi-Hansberg, E. & Wright, M. L. J. (2007), 'Urban Structure and Growth',
Review of Economic Studies **74**(2), 597–624.