SEVENTH FRAMEWORK PROGRAMME

"Ideas" Specific programme

European Research Council

Grant agreement for: Advanced Grant

Annex I - "Description of Work"

Project acronym: *MACROINEQUALITY*

Project full title: The Macroeconomics of Inequality, Development and the Welfare State

Grant agreement no.: *324085*

Duration: 60 months

Date of preparation of Annex I (latest version): 11.3.2013

Principal Investigator:
Kjetil Storesletten

Host Institution:
University of Oslo

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Summary:

This project will develop macro models with heterogeneity across people and firms to understand the consequences of two profound macro trends: the economic transformation of China and the rising cross-sectional inequality in many countries. The ultimate aim is to help these models become everyday tools in macro, development/labor economics, and actual policy making.

Inequality and human capital accumulation is an important theme. I will develop tractable models of the equity-efficiency tradeoffs under risk and imperfect financial markets. Due to novel general equilibrium effects, progressive taxation is particularly distortive for education choices. This calls for complementary policies. I also explore the nexus between inequality and aggregate risk, and the interaction between inequality and the dynamics of political conflict.

The project will provide sharper tools for policy analysis. A key aim is to integrate models of mistakes into structural macro models. While such models generally assume rationality, welfare programs are often geared to precisely address negative consequences of human errors. Assuming information is costly, I will quantify bounds on rationality to match observed behavior. The framework has a wide range of potential uses. I will use it to reevaluate government programs.

A large part of the project focuses on China. The rapid economic transformation of emerging economies has raised many new questions for economic theory and policy. I will marshal the use of models with heterogeneity to address these issues. A key goal is to develop a quantitative structural model that can become the benchmark model of fiscal policy analysis and long-run forecasts in China. As an application, I will study cost and gains of various redistribution programs. The project also aims at examining the sources of growth and inflation in China and, ultimately, understanding the culprit of the Chinese growth miracle.

Section 1: *The Principal Investigator*
1.a. Curriculum Vitae : KJETIL STORESLETTEN, http://folk.uio.no/kjstore/
Current Positions:

Professor of Economics, University of Oslo	2012-
Visiting Professor (part-time), University of Zurich	2008-

Past Positions:

Monetary Advisor, Federal Reserve Bank of Minneapolis (full-time position)	2009-2012
Professor of Economics, University of Oslo	2003-2009
Associate Professor, IIES (Stockholm University) (tenured in 2001)	1995-2003

Current Professional Activities:

Board of Directors, Review of Economic Studies	2012-
Editorial Board, Review of Economic Studies	2003-
CEPR Research Fellow	2002-
Editor, Scandinavian Journal of Economics	2012-
Op-ed columnist in the Norwegian newspaper Dagens Næringsliv	2012-

Past Professional Activities:

Managing Editor of the Review of Economic Studies	
(Review of Economic Studies is a top-5 journal in economics)	2006-2010
Editor, BE Press Journals of Macroeconomics	2005-2006
Associate Editor, Review of Economic Dynamics	2004-2007
Associate Editor, International Economic Review	2002-2006
Op-ed columnist in the Norwegian newspaper Aftenposten	2005-2012

Education:

Ph.D. Economics, University of Carnegie Mellon	1991-1995
Siviløkonom (M.A.), Norwegian School of Economics and Business Administration	1987-1991.

Shorter visits:
Yale (October 2005); University College London (October 2004); UC Los Angeles (April 2002); U of Pennsylvania (April-May 1999); FRB Minneapolis (August 1996).

Selected Recent Publications
(not listed in 10-year track record, with total google.scholar count, including citations to CERP working paper versions and previous titles of papers)

1. Storesletten, K., 2000. "Sustaining Fiscal Policy Through Immigration," **Journal of Political Economy**, 108 (2), pp. 300-324.   **GS 424**.
2. Storesletten, K., C. Telmer, and A. Yaron, 1999. "The Risk Sharing Implications of Alternative Social Security Arrangements," **Carnegie-Rochester Conf. Series on Public Policy**, 50, pp. 213-260. **GS 133**
3. Storesletten, K., C. Telmer, and A. Yaron, 2001. "The Welfare Costs of Business Cycles Revisited: Finite Lives and Cyclical Variation in Idiosyncratic Risk," **European Economic Review**, 45, pp. 1311-1339.   **GS 132.**
4. Hassler, J., P. Krusell, K. Storesletten, and F. Zilibotti, 2005. "The Dynamics of Government," **Journal of Monetary Economics**, 52 (7), pp. 1331-1358.   **GS 65**
5. Storesletten, K., C. Telmer, and A. Yaron, 2001. "How Important Are Idiosyncratic Shocks? Evidence from Labor Supply," **American Economic Review** (P&P), 91, pp. 413-417.   **GS 49.**
6. Heathcote, J., K. Storesletten, and G. Violante, 2005. "Two Views of Inequality Over the Life-Cycle," **Journal of the European Economic Association,** 3 (2-3), pp. 543-52.   **GS 53**
7. Hassler, J., K. Storesletten, and F. Zilibotti, 2003. "Dynamic Political Choice in Macroeconomics," **Journal of the European Economic Association**, 1 (2-3), pp. 543-52.   **GS 8**
8. Backus, D., E. Henriksen, and K. Storesletten, 2008. "Taxes and the Global Allocation of Capital," **Journal of Monetary Economics**, 55 (1), pp.48-61.   **GS 27**
9. Hassler, J., P. Krusell, K. Storesletten, and F. Zilibotti, 2008. "On the Optimal Timing of Capital Taxation," **Journal of Monetary Economics**, 2008, 55 (4), pp. 692-709.   **GS 8.**
10. Hassler, J, J Rodriguez Mora, K Storesletten, and F Zilibotti, 2005. "A Positive Theory of Geographical Mobility and Social Insurance," **International Economic Review**, 46 (1), pp. 263-303.   **GS 58.**
11. Heathcote, J., K. Storesletten, and G. Violante, 2009. "Quantitative Macroeconomics with Heterogeneous Households," **Annual Review of Economics**, 1, pp 319-354.   **GS 80.**

Other papers

Heathcote, J., K. Storesletten, and G. Violante, 2012. "Consumption and Labor Supply with Partial Insurance: An Analytical Framework," resubmitted to **American Economic Review**, 2nd round. **GS 63**

PhD Advising (year PhD, first job)
Martin Flodén   (1999, Stockholm School of Economics), Co-advisor
Matthew Lindqvist   (2002, Stockholm University),
Conny Olofsson   (2004, Stockholm School of Economics),
Thomas Eisensee   (2006, Swedish Ministry of Finance), Co-advisor
Lars Johansson   (2009, Swedish Ministry of Development), Co-advisor
Dag Holen   (2007, Norwegian Ministry of Labor),
Ole Christian Bech-Moen (2007, Private Sector)
Weizhen Zhu   (2009. Norwegian Government),
Øystein Børsum   (2010, Norwegian Ministry of Finance),
Sun Gang   (2011, St. Andrew's University)
Bo Zhao   (2012, Peking University)
Ola L Vestad   (2012, Statistics Norway)

Grants
For the period 2004-2009 I received an Outstanding Young Investigator grant from the Norwegian Research Council (7 mill NOK, i.e., more than one million USD). This is the most prestigious award to young scientists in Norway (26 similar grants were awarded across all academic fields and 2004 was the first time such grants were issued).
1998-2000 Carl Mannerfelt's Foundation.

Funding ID
As an employee in the FRB system I cannot hold any outside grants. I am therefore not funded by any existing research grants. If I get ERC funding, I will resign from my current position at FRB Minneapolis. Note that during my time at University of Oslo I was successful at obtaining large research grants (about €185,000 per year during 2004-2009, see "Grants" above).

There is and there will be no funding overlap with the ERC grant requested and any other source of funding for the same activities and costs that are foreseen in this project.

International collaboration
I finished my PhD at Carneige Mellon University in 1995, with Nobel Laureate Finn E. Kydland and José Víctor Ríos-Rull as advisors.

My international collaboration has consisted of long-standing co-authorship with a large number of economists around the world. These include the following:
Fabrizio Zilibotti (University of Zurich),
Zheng Song (University of Chicago),
Gianluca Violante (New York University),
John Hassler (IIES, Stockholm University),
Per Krusell (IIES, Stockholm University),
Loren Brandt (University of Toronto),
Gueorgui Kambourov (University of Toronto),
Christopher I. Telmer (Carnegie Mellon University),
Amir Yaron (University of Pennsylvania),
Jonathan Heathcote (FRB Minneapolis),
Motohiro Yogo (FRB Minneapolis),
José-Vincente Rodríguez Mora (University of Edinburgh),
José Víctor Ríos-Rull (University of Minnesota),
Yan Bai (University of Rochester),
David Backus (New York University)

1.b. 10-Year-Track-Record
I have in total 28 papers, six of which in top-three journals in economics, plus one in 2nd round at *AER*. 18 are in peer reviewed journals, 3 in conference volumes, and 4 book chapters.

My research appears on the reading lists of PhD courses worldwide, including at the top universities (such as e.g. MIT, Berkeley, Harvard, Yale, and Northwestern). I have been cited more than 2500 times, according to scholar.google (omitting multiple citations in the same paper). According to the Research Papers in Economics (RePEc/IDEAS) ranking, I am among the top 1% economists in the world (no. 199) in terms of citations, weighted by recursive impact factor, and discounted by citation age.

Over the last two years I have received tenured offers from three top-10 departments in macroeconomics, namely Northwestern, Minnesota, and UCLA. During the period 2006-2010, I was a managing editor of the Review of Economic Studies, which is a top-5 journal in economics. I am now serving on the 4-member board of directors of the same journal. I am currently a co-editor of the Scandinavian Journal of Economics.

Top 10 publications (with total google.scholar count, incl. citations to previous titles of paper)
1. Heathcote, J., K. Storesletten, and G. Violante, 2010. "The Macroeconomic Implications of Rising Wage Inequality in the United States," **Journal of Political Economy**, 118 (4), 681-722.   **GS 251**
2. Song, Z., K. Storesletten, and F. Zilibotti, 2011. "Growing Like China," **American Economic Review**, 101(1), pp. 196-233.   **GS 100**
3. Hassler, J., J.V. Rodriguez Mora, K. Storesletten, and F. Zilibotti, 2003. "The Survival of the Welfare State," **American Economic Review**, 93 (1), pp. 87-112.   **GS 209**
4. Storesletten, K., C. Telmer, and A. Yaron, 2004. "Cyclical Dynamics in Idiosyncratic Labor-Market Risk," **Journal of Political Economy**, 112 (3), pp. 695-717.   **GS 300**
5. Storesletten, K., C. Telmer, and A. Yaron, 2007. "Asset Pricing with Idiosyncratic Risk and Overlapping Generations," **Review of Economic Dynamics**, 10 (4), pp. 519-548.   **GS 298**
6. Storesletten, K., C. Telmer, and A. Yaron, 2004. "Consumption and Risk Sharing over the Life Cycle," **Journal of Monetary Economics**, 51 (3), pp. 609-633.   **GS 357**
7. Heathcote, J., K. Storesletten, and G. Violante, 2008. "Insurance and opportunities: A welfare analysis of labor market risk," **Journal of Monetary Economics**, 55 (3), pp.501-525.   **GS 67**
8. Hassler, J., K. Storesletten, and F. Zilibotti, 2007. "Democratic Public Good Provision," **Journal of Economic Theory**, 133 (1), pp. 127-151.   **GS 51**
9. Storesletten, K., 2003. "Fiscal Implications of Immigration - a Net Present Value Calculation," **Scandinavian Journal of Economics**, 105 (3), pp. 487-506.   **GS 91**
10. Song, Z., K. Storesletten, and F. Zilibotti, 2012. "Rotten Parents and Disciplined Children: A Politico-Economic Theory of Public Expenditure and Debt," **Econometrica**, 80 (6), pp. 2785-2804. **GS 43**

Impact of top papers
My research has helped introduce individual heterogeneity in macroeconomics and shaped research in this area. A major result is that wage and earnings inequality alone is enough to explain the dynamics of inequality in consumption and hours (Storesletten et al. 2004a; Heathcote et al. 2010, 2012). Moreover, Storesletten (2007) and Heathcote et al. (2008, 2010) showed that cross-sectional inequality has aggregate effects. Finally, Storesletten (2000) has had a large impact on research and debate on effects of immigration.

A second line of research lies in transition economies: Song et al. (2011) develop a model of economic transition which can explain the salient macroeconomic trends in China. These trends are very non-standard and ours is the first macroeconomic model that can explain them. The article has sparked a large interest.

My third line of research is on dynamic political economy. This work has helped us understand how to solve models with repeated voting, and has shown how this aspect can both undermine and strengthen the viability of the welfare state (Hassler et al., 2003, 2005, 2007; Song et al., 2012).

Research Monographs
The following articles have appeared as contributions to monographs :

"The Risk Sharing Implications of Alternative Social Security Arrangements," (with C. Telmer, and A. Yaron), Carnegie-Rochester Conference Series on Public Policy, 50, pp. 213-260, 1999. Reprinted in

Robin Brooks and Assaf Razin (eds.) *Social Security Reform, Financial and Political Issues in International Perspective*, Chapter 6. Cambridge University Press, Cambridge MA, 2005.   **GS 133**.

Quantitative Macroeconomics with Heterogeneous Households (w/Heathcote and Violante) **Annual Review of Economics**, 1, 319-54 (among the 5 most cited papers ever published in Ann. Reviews of Economics)

"Asset Prices and Intergenerational Risk Sharing: The Role of Idiosyncratic Earnings Shocks" (with Telmer and Yaron). Handbooks in Finance; Handbook of the Equity Risk Premium, ed. by Rajnish Mehra, Elsevier, Amsterdam, pp. 565-590, 2008.

"Kjetil Storesletten's Research Agenda on Inequality in Macroeconomics" (invited profile of my research on macroeconomics and inequality) The Economic Dynamics Newsletter 5 (1), 2003.

"From Wages to Welfare: Decomposing Gains and Losses from Rising Inequality" (w/Heathcote and Violante) in *Advances in Economics and Econometrics: Theory and Applications, Tenth World Congress*, ed. by D. Acemoglu. Forthcoming.

Invited lectures

2011	Invited Lecture at the Asian Meetings of the Econometric Society (Seoul, Korea).
2004, 2011	Invited Lectures at the Annual meeting of the European Economic Association
2009, 2011	Keynote speaker at the Tsinghua Workshop in Macroeconomics

Invited presentations advanced research institutions (presenting my own research), a subset:

Princeton, Stanford, Chicago, MIT, Yale, Columbia, NYU, Northwestern, Minnesota, University of Pennsylvania, Rochester, Carnegie Mellon, UCLA, UCSD, UCSB, Arizona State, U of Texas: Austin, Duke, U of Wisconsin, John Hopkins U, U of Iowa, Georgetown, University College London, LSE, Oxford, U of Toronto, Queen's U, McMaster U, Chicago Fed, New York Fed, Federal Reserve Board, European University Institute, CREi, Paris School of Economics, Toulouse U, European Central Bank, Bocconi, U of Venice, Ente Enaudi, Mannheim, Humboldt, Frankfurt, Tinbergen Institute, Copenhagen, IIES, Stockholm School of Economics, Warwick, Southampton, Cambridge, Pompeu Fabra, Carols III, Cemfi, several CEPR and NBER conferences.

Invited Cycles of Lectures: UCLA (2001 and 2011), Yale (2005), Northwestern University (2011), University of Porto (2004), Aarhus University (2004), Fudan University (2006), and Aalto University, Finland (2010).

Organisation of International conferences

2011 (co-chair)	Minnesota Workshop in Macroeconomic Theory. This is perhaps the most prestigious annual macro conference.
2006 (main organizer)	Review of Economic Studies Tour, Norway leg.
2007-2012 (co-chair)	Nordic Symposium in Macroeconomics. This is an annual conference

targeting young economists with ties to Nordic countries. It has become an important meeting point that is stimulating macroeconomic research in the Nordic countries.

| 2001 (local organizer) | Annual Meeting of the Society of Economic Dynamics (in Stockholm) |
| Scientific committee | Annual Meeting of the Society of Economic Dynamics (various years) and the Annual Meeting of the European Economic Association (various years). |

Awards and Memberships

Managing Editor of the **Review of Economic Studies**,	2006-2010.
Editor of the **Scandinavian Journal of Economics**,	2012-
Director of the **Review of Economic Studies**	2012-
Board Member of the **Review of Economic Studies**	2003-
Editor of the **BE Press Journal of Macroeconomics**,	2004-2006

Former Associate Editor of the **Review of Economic Dynamics** and the **International Economic Review**.

Research Fellow of CEPR

Outstanding Young Investigator grant from the Norwegian Research Council (7 mill NOK = 960,000 € over the 2004-2009 period). This is the most prestigious award and research grant to young scientists in Norway.

Examples of leadership

I have advised ten PhD students in my career. Six of these remain active in academic research (Martin Flodén (Stockholm U), Matthew Lindqvist (Stockholm U), Conny Olofsson (IIES), Sun Gang (St. Andrew's U), Bo Zhao (Peking U), and Ola Vestad (Statistics Norway). I have also supervised two postdoctoral fellows at U of Oslo: Kaiji Chen (now Emory U) and Espen Henriksen (now UC Davis).

Section 2: *The Project proposal*

a. State-of-the-art and objectives

This proposal aims at developing macroeconomic models with heterogeneity and to use these methods to understand the effects of two profound macroeconomic changes over the last 50 years, namely the rapid economic transformation of China and the rising cross-sectional inequality within developed and developing countries. The welfare effects of government redistribution policies is a recurrent theme throughout the proposal.

Macroeconomics has traditionally been about business cycles and growth, focusing on outcomes such as aggregate employment and consumption. Since the rational expectation revolution in the 1970s, the main workhorse has been the representative agent model. Subsequently, there has been a growing interest in introducing heterogeneity in macroeconomics. This was driven by several factors. One was the insight that heterogeneity can play an important role for macroeconomic dynamics. Moreover, many empirical observations seem puzzling in light of the neoclassical representative agent model. Perhaps most importantly, many macro questions of great relevance simply cannot be addressed without allowing for at least some heterogeneity. For example, to study social security requires a model in which agents differ by age. One of the key macroeconomic trends of the recent past is the dramatic widening of the wage structure in many developed and developing countries, such as the widening wage gap between rural and urban workers in China. These trends and their implications for policy and welfare can only be explored within heterogeneous agent models of the macroeconomy (e.g., Krueger and Perri 2006; Attanasio et al. 2008; Heathcote et al. 2010).

More broadly, macroeconomics is expanding from the study of how average values for the inputs (capital and labor) and outputs (consumption) of production are determined in equilibrium to the study of how the entire distribution of these variables across households is determined. This expansion is crucial for policy analysis, for two reasons. First, volatility at the level of individual workers and firms is orders of magnitude larger than aggregate volatility. Thus, the welfare implications of policies that redistribute across agents are potentially much larger than the implications of policies aimed at stabilizing the aggregates. Second, the evaluation of large-scale government programs (such as e.g. social insurance and tuition subsidies) requires models that take into account both general equilibrium effects and the heterogeneous impact of policies across the population. In other words, for many economic issues we care much more about the distribution of outcomes (such as e.g. how the lower tail of the population fares) than about the aggregate outcomes.

China poses a new and exciting set of questions for economists. First, it is imperative to understand the causes and effects of the rapid economic transformation, which is arguably the most significant economic event in our lifetime. Second, the sheer speed of this transition gives rise to a set of new issues for policy and economic theory. Third, a growing amount of economic data is becoming available –both aggregate data and micro data sets. This helps in identifying economic puzzles and indicating the direction theory should move to understand China's transition and guide Chinese policy makers. As the academic literature studying the Chinese economy is starting to take off, it is becoming clear that the heterogeneity between firms, regions, and people is substantially larger than in western economies (van Biesebroeck et al. 2009; Hsieh and Klenow 2009; Song et al. 2011). The main focus of economic policy in China has been on promoting growth. However, the rising inequality has made social welfare and policies promoting a broader sharing of the fruits of growth into salient policy issues.

The proposal focuses on three themes, with the following seven specific subprojects:
- A1.   Education, risk, and redistribution
- A2.   Inequality and aggregate fluctuations
- B.   Human mistakes in macro models
- C1.   Sharing growth: China's welfare state in transition
- C2.   Trade surplus and currency manipulation
- C3.   Regional growth disparities in China
- C4. Dynamic political economy

Subproject A1: Education, risk, and redistribution (with Violante, Heathcote, and post doc 1)
The rise in U.S. wage inequality has caused substantial concern and debate, stemming from the presumption that observed movements in the relative wage structure have had sharply negative welfare consequences for US households, in particular for the low skilled. The merit of this argument hinges on the

extent to which the increased wage volatility is (self-) insurable or not, and the extent to which workers have the flexibility to take advantage of working more when they are productive (Heathcote et al., 2008).

Those who emphasize potential welfare gains from changes in the wage structure focus on higher returns to human capital investment. Since wage differentials attributable to education are permanent and ex ante uninsurable, they translate one for one into consumption differentials (Attanasio and Davis, 1996). A rising college premium thus leaves college graduates better off and high school graduates worse off. But this argument is incomplete because higher education is arguably an individual choice. New cohorts can take advantage of the opportunities presented by skill-biased demand shifts – and the associated larger return to education – by increasing their investment in human capital. This behavioral response can be a source of welfare gains, as demonstrated by Heathcote et al. (2010).

The aim of this subproject is to understand better the welfare effects of a changing wage structure – including a rising college premium – and to investigate how these changes influences the optimal government policy in general equilibrium. In terms of positive contributions, I will explore how redistribution affects labor supply and educational investments. Moreover, I will explore if redistributional policies achieve the intended risk sharing, or if it merely crowds out private insurance. An important aim is to compute the optimal government redistribution policies and to quantify the welfare effects of such policies. I intend to explore several different government redistribution policies such as progressive taxation, disability pensions, and educational subsidies. While there is a large literature addressing the trade off between redistribution and crowding out of labor supply, I will focus also on an additional channel of dynamic distortions, namely educational investments.

A key challenge will be to make sure the model can explain the empirical distribution of labor supply, education, and wages over time, and also explain how these choices interact with individual wealth.

Subproject A2: Inequality and aggregate fluctuations (with Violante, Heathcote, and post doc 1)

While macroeconomics generally abstracts from heterogeneity, studies of inequality often abstract from aggregate fluctuations. The purpose of this subproject is to explore how fluctuations in heterogeneity can have aggregate effects, and how these effects may influence asset prices and the cost of business cycles.

In an influential paper, Krusell and Smith (1998) argue that heterogeneity has small effects on business cycle fluctuations. Subsequently, Pijoan-Mas (2006) and Heathcote et al. (2008, 2010, 2012) have shown that the level of wage risk can have aggregate implications but that the direction of these effects depend on the nature and insurability of the wage risk. The intuition is that in response to an uninsurable wage shock, the unlucky ones will want to work harder to make up for the loss in earnings, provided that risk aversion is reasonably high. Therefore, larger uninsurable risk will reduce average productivity and aggregate consumption. Conversely, larger insurable risk will allow workers to take advantage of working more in periods when they are more productive, which in turn will increase average productivity per hour and aggregate consumption.

The idea of the subproject is to study the aggregate effects of time-varying inequality. Mankiew (1986) and Constantinies and Duffie (1996) showed that if permanent inequality increases in recessions and people have CRRA preferences over consumption, then individual risk will increase the financial equity premium. Moreover, Storesletten et al. (2001) argue that such a pattern for inequality will exacerbate the welfare costs of business cycles.

We want to derive a better understanding of how aggregate and individual risk interact with labor supply, and how it shapes the financial risk premium and the cost of business cycles. We expect that the distinction between insurable and uninsurable risk will be crucial. Moreover, we will estimate how much of the aggregate fluctuations and asset prices that can be attributed to time-varying fluctuations in risk and inequality. An important aim is to investigate if the conclusions on Krusell and Smith (1998) will hold up in our setting.

Subproject B: Human mistakes in macro models (with Yogo and post doc 2)

Macroeconomic models with rich heterogeneity have already been brought to bear on a number of policy issues ranging from unemployment insurance to reforms of the pension system. These studies generally assume full rationality and time-consistent preferences. A common finding is that the welfare gains from government-provided insurance is small and generally dominated by the welfare costs on the distortions on decisions such as labor supply, savings, and private insurance purchases. Social security offers a particularly stark example where the potential gains from (inter- and intra-generational) risk sharing and from providing (annuity) assets are dwarfed by the long-run losses from crowding out of aggregate capital (see for example Hong and Rios-Rull 2007; Krueger and Kubler 2006; and Storesletten et al. 1999).

The assumption of full rationality, which is key for these theoretical results, stands in sharp contrast to the popular view that the pension system is put in place as a security net for those who make mistakes and save less than they should have done during their working lives. In line with this alternative view, a large literature has documented that many people make errors in their financial planning for retirement (see e.g. Lusardi, 2009, and Choi, Laibson, and Madrian, 2011). For example, in the context of purchase of life insurance and annuities, Koijen et al. (2012) document that there is a very large dispersion in observed allocations, and that the allocations are very different from those predicted by observables such as age, health, and wealth. They estimate that the welfare loss of such insurance market misallocation is staggering – around 30% of lifetime consumption for people at 50 years of age.

The aim of this subproject is to introduce a model of bounded rationality in an otherwise standard macroeconomic model with heterogeneity. The purpose is to revisit the design of welfare state policies and, in particular, pension reform when human errors and bounded rationality are taken into account.

One approach for making economic models more in line with empirical data on the micro level is to allow for e.g. extensive unobserved preference heterogeneity (Browning et al., 2010). However, Koijen et al. (2012) show that even without any preference heterogeneity the rational model generates an empirically plausible dispersion in insurance purchases. Therefore, if one were to add some source of orthogonal dispersion in insurance payments through e.g. preference shocks or measurement error, then the model would feature too large unconditional dispersion. The challenge, then, is to increase the dispersion in allocations *conditional* on the observables (age, health, and wealth), without getting excessive *unconditional* dispersion. A model where decision makers are partially inattentive will deliver exactly this feature. The reason is that, by construction, inattention implies that the decision maker has not incorporated the most recent changes in observables – the current choices reflect state variables of the past.

The potential gains for this subproject are large. The grand aim of modern macroeconomics is to build a structural model of human behavior that is sufficiently rich to capture human behavior – in the sense that it is consistent with salient facts from both macro and (individual-based) labor economics – and sufficiently simple that it remains tractable and can be useful for addressing real policy questions. A major obstacle for having policy makers to take seriously macroeconomic implications of policy reforms is that these models have so far lacked a convincing element of human error. The ultimate aim of this project is to bridge the gap between policy makers and economists working with structural models in macro and labor. A convincing resolution to the tension between theorists and practitioners can open important new possibilities for using economic insights in economic policy.

Subproject C1. Sharing growth: China's welfare state in transition
(with Song, Wang, Zilibotti, post doc 3, and graduate student)

While China's economic transition represents a "growth miracle," the success is lump-sided: cross-sectional inequality is rising and the welfare of the majority of the population is not keeping pace with the high output growth. The rising inequality has caused a shift in policy makers' attention from a singular focus on growth to a broader aim of promoting social welfare. For example, at a press conference on March 14 2012, Wen Jiabao – ranked as China's third most powerful politician – stated that

"I know that social inequities... have caused the dissatisfaction of the masses. We must push forward the work on promoting social equity ... The first issue is the overall development of the reform of the income distribution system."

Is it possible to allow more people to share the benefits of high growth without choking the economic performance? If so, what institutional arrangements can achieve such goal? This subproject aims at addressing these questions by undertaking a systematic evaluation of the (limited) Chinese welfare state, and possible reforms of it, within a fully specified general equilibrium model of the economic transformation. The ultimate aim is to provide a prototype quantitative model for analyzing fiscal policy and the economic transformation of China, where this model can serve as a benchmark for researchers and policy makers.

As a first pass, we will focus on three growing cleavages and potential policies to mitigate the effects of the growing dispersion in China: the differences between young and old generations, the difference between urban and rural areas, and the difference between workers and entrepreneurs/capitalists.

The urban-rural income gap has been a particular source of concern in China. The urban wage premium has increased from 26% to 68% since 1990. The fact that young workers are migrating in droves to urban areas implies that the countryside is ageing extremely rapidly, undermining the rural tax base. A key goal of this subproject is to quantify how costly would it be to extend the urban welfare state arrangements to rural areas.

The intergenerational inequality is also widening, partly due to the fast productivity growth that makes the labor market perspective of a worker entering the labor force today substantially better than that of a

worker who entered in, e.g., 1970. The fact that many old households have just a single child (due to the one-child policy) adds to this concern. We will explore how effective the existing urban welfare state institutions, such as e.g. the pension system, are at mitigating intergenerational inequality. Some preliminary results suggest that these institutions are not sustainable in light of the looming ageing of the Chinese society.

In terms of capitalists and workers, the Chinese growth is arguably influenced by both capitalists' investments and the access to cheap labor. What would the consequences be–in terms of growth, wages, and welfare–if the government ramped up capital taxation and progressive taxation to achieve redistribution?

The subproject is also aimed at addressing broader quantitative economic issues for China, such as that of exploring what drives the large savings rates. Understanding this behavior is key for predicting future aggregate savings and, hence the future Chinese foreign surplus. There are probably limits to how large Chinese surplus the world's capital markets can possibly swallow. If so, should the government do something to increase domestic consumption and investment?

These important public policy questions require quantitative answers. This subproject will build a state-of-the-art quantitative model of economic development in China to address these issues.

Subproject C2:
Trade surplus and currency manipulation (w/Song, Zilibotti, post doc 3, and graduate student)

One of the most significant events in international economics over the last decades is the emergence of global imbalances, partly driven by China's vast and growing foreign surplus: its foreign reserves grew from $21 billion in 1992 (5% of its annual GDP) to more than $3 trillion in 2011 (more than 50% of GDP).

A common argument in the west is that the culprit of global imbalances is the exchange rate manipulation carried out by the Chinese authorities, who peg the RMB to the dollar. According to the Peterson Institute for International Economics, the RMB is undervalued by at least 25% to 40%. The manipulation thesis rests on the simple idea that the imbalance itself is evidence of a misalignment of the exchange rate. Letting market forces determine the exchange rate would, according to this view, restore trade balance.

Unfortunately, the proponents of this view do neither spell out explicitly the mechanism of their claim nor do they provide much evidence corroborating it. Clearly, it is the real exchange rate that matters, not the nominal one. During the period 1980-1994 – before China's accession into WTO and the main growth of private firms– growth was highly correlated with inflation (Brandt and Zhu, 2000). However, after 1995 this relationship has been non-existent: between 1997 and 2007 the inflation rate was on average about the same as in the US, and the real exchange rate has accordingly remained constant (see McKinnon 2006, Figure 3). Interestingly, this is exactly the period when the growth in output and in foreign surplus was the largest.

The question, then, is: how could China possibly maintain a severely misaligned real exchange rate for more than a decade, without feeding domestic inflation pressure, e.g., by increasing the demand of non-traded goods and stimulating domestic wage pressure? As a comparison, when many European countries repeatedly devalued their currencies in the 1980, the only effect remaining two-three years after the devaluation was an increased inflation. The fact that China's standard of living increased at a staggering pace during this period amplifies the puzzle: one would expect that as people get richer, they consume a larger share of non-traded goods, and this should feed into domestic wage growth.

This subproject aims at taking the currency-undervaluation thesis seriously by modelling such manipulation explicitly and studying how its theoretical predictions matches up with the empirical evidence for China.

Subproject C3: Regional growth disparities in China
(with Loren Brandt, Gueorgui Kambourov, post doc 3, and graduate student)

China has – by any measure – had an impressive growth since the economic liberalization started around 1980. Urban wages are about ten times larger today than thirty years ago. In just two decades industrial centers in China such as Guangdong and Shanghai have emerged as major world producers of goods such as apparel and electronics. However, the growth is not evenly distributed across different regions in China – it is the coastal regions which have grown, both in terms of GDP per capita and in terms of population, due to internal migration. For example, GDP per capita in coastal regions is nearly two and half times larger than GDP per capita in internal and western regions.

Song et al. (2011) argue that China's growth is intimately tied to the emergence of domestic private enterprises (DPE) and the associated decline of state-owned enterprises (SOE). Interestingly, in the 1970s the main industrial base and the largest GDP per capita were in the central regions and not on the coast. For historical reasons, Chinese planners allocated large investments in SOEs internal regions (i.e., Mao's "third front" to shield the industrial base from foreign invasion). Brandt et al. (2008) documented that the growth in

the employment share of non-state enterprises, their share of capital formation, and provincial GDP grew faster in provinces that had a lower SOE presence in 1978.

The aim of this subproject is to understand the sources of growth in China and, in particular, to understand the reversal of fortune: why did the coastal regions take off, while the internal regions lagged behind, despite their large initial industrial base? The standard view in economics is that the growth miracle in China and other Asian tigers is due to a rapid catching-up with industrialized countries (cf. Hsieh and Klenow 2009). The underlying premise is that growth was suppressed in China due to a large number of distortions. Once some of these frictions were relaxed or removed, the economy took off. According to this view, the culprit of the growth disparities across Chinese regions must be that distortions preventing private enterprise were removed in coastal regions with a much smaller SOE sector while such distortions remained in place in internal regions where SOEs had a large initial presence. The question, then, is what are these distortions?

2.b. Methodology

I now lay out a detailed description of the methodology for each of the subprojects.

Subproject A1: Education, risk, and redistribution (w/Violante, Heathcote, and post doc 1)

As discussed above, the aim of Subproject 1 is to investigate how the changes in wage risk and in the college premium influence the optimal government policy in general equilibrium. A key methodological aim is to address these questions by extending the Heathcote et al. (2012) framework. Their model yields a tractable analytical characterization of allocations in an important class of incomplete markets models (see below for details). This approach has the advantage that it makes the arguments more transparent and allows the reader to see clearly all economic forces. Moreover, it allows a direct and simple mapping from model to data, without having to resort to numerical simulations of the model.[1]

Government policies: The subproject will consider three types of government redistribution policies: progressive taxation, disability pensions, and educational subsidies. Consider first disability pensions. If the state of disability were perfectly observable, then the welfare properties of such insurance would be trivial: provide full insurance to those who are disabled. However, if this state is unobservable, then there will be a trade off between insurance and crowding out of labor supply. We will explore a setting where such a welfare program is modeled as a lower bound on income. This requires a major extension of Heathcote et al. (2012) and the challenge will be to achieve this and still retain analytical tractability of the model.

In terms of progressive taxation, attention will be restricted to tax policies which are simple and close to actual policies: the government can tax current labor earnings but is restricted to have the same tax schedule for everyone. Following Benabou (2000) and Heathcote et al. (2012), attention is restricted to a class of tax-transfer functions where after-tax earnings y are given by $y = (1-\delta) (x)^{1-\tau}$, given before-tax earnings *x*. Here, $\tau>0$ implies progressive taxation (i.e., rising marginal tax rate) and δ captures a proportional tax. The downside of considering such simple tax systems is that the government could potentially do better by computing the gory details of the Mirrleesian tax schedules. The advantages of the simple system are that one gets a sense of the direction that actual policies should be twisted (i.e., more or less progressive), and the implications are sharper and more robust to changes in for example the distribution of wages. A key question will be if the observed changes in the wage structure should induce more or less progressivity over time.

The basic model: Following Katz and Murphy (1992) and Heathcote et al. (2010), output is given by the production function

$$Y = [\zeta (N_H)^{(\theta-1)/\theta} + (1-\zeta) (N_L)^{(\theta-1)/\theta}]^{\theta/(\theta-1)},$$

where N_j is aggregate labor supply of type $j \in \{L,H\}$ and ζ represents the technological bias in favor of high-skilled labor. If labor markets are competitive, then the skill premium, i.e., the average hourly wage of high-skilled workers P_H over the wage of low-skilled workers P_L, is given by

$$ln(P_H/P_L) = ln(\zeta/(1-\zeta)) - (1/\theta) ln(N_H/N_L).$$

Hence, the skill premium increases if either there is skill-biased technical change or if the relative supply of high-skilled labor declines. We will model the college premium as stemming from an interaction between exogenous skill-biased technical changes and endogenous movements in the relative supply of skilled labor.

The model for individual consumption and labor supply decisions builds on Heathcote et al. (2012). We make three key assumptions: (1) preferences are CRRA over consumption and labor supply: $u(c,h)=c^{1-\gamma} /(1-\gamma) - \phi \cdot h^{1+\sigma}$, (2) the market structure is exogenous: before-tax hourly wages are given by

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[1] I should emphasize that an analytical solution is not an end in itself. Once the arguments are well understood, one should build models with more details and realistic mechanisms (see subproject B for one such attempt).

$log\ w_{jt} = p_j + \alpha_t + \varepsilon_t$, where p_j is the return to education of type j. Moreover, there is complete insurance against some shocks (ε_t) and no insurance markets against other shocks (α_t), where α_t is a unit-root process, and (3) aggregate supply of assets is zero. Heathcote et al. (2012) prove that the equilibrium allocations can be expressed in closed form as a log-linear combinations of the latent factors α and ε:

$$\ln c = ((1+s)/(s+\gamma))\ (1-\tau)\ (\alpha+p) + C$$
$$\ln h = ((1-\gamma)/(s+\gamma))\ (\alpha+p) + (1/s)\varepsilon + H,$$

where C and H are constants common across workers and $1/s \equiv (1-\tau)/(\sigma+\tau)$ is a tax-modified Frisch elasticity.

     Finally, a key component of this analysis is to develop a fruitful model of educational investment. As is well known, IQ scores are highly correlated with educational attainment. This suggests that a model of education must include heterogeneous costs. The model must also be able to replicate educational choice over time and across countries. I will explore two alternative models of education: a model with a 0-1 choice (college or no college) extending the simple educational attainment model in Heathcote et al. (2010), and a model with a continuous choice of investment (number of years of education).

     Based on numerical simulations, Heathcote et al. (2010) illustrate that in the 0-1 education model, skill-biased technical change has a direct effect on increasing the college premium and increasing the college attendance. This general equilibrium effect will tend to mitigate the rise in inequality. This points toward an important and novel effect of redistribution: More progressive taxation is partially offset by a general equilibrium effect on the college premium: while increased progressivity will decrease the after-tax college premium, people will respond by reducing their college enrollment (see Guvenen et al., 2009). This will, in turn, make the before-tax college premium widen, which will mitigate the reduction in consumption inequality. More generally, higher enrollment has a positive externality in terms of reducing inequality. I expect that when taking this novel externality it into account, the optimal degree of progressivity will fall.

     In other words, progressive taxation may be a relatively good way to redistribute against differences in innate ability, but a poor way to redistribute against differences in productivity that reflect differential investments, because it will work to reduce those investments: more compression ex post leads to more inequality ex ante. The quantitative merits of this argument hinges on the elasticity of educational enrollment to changes in the college premium, as well as the risk aversion and Frisch elasticity of labor supply.

     Regarding disability insurance, the standard trade-off between such insurance and crowding out of labor supply, emphasized by e.g. Low and Pistaferri (2010), is present also here. This subproject adds two novel arguments to this debate. First, Heathcote et al. (2012) show that if risk aversion is high, then the less skilled workers will work more hours. This would lower average productivity. The ex-ante efficient allocation (i.e., allowing unlimited trade in insurance before birth) dictates a perfect correlation between individual productivity and hours worked: one should make hay when the sun shines. Disability pensions reduces labor supply of the least productive, which is exactly what the efficient allocations prescribes. In other works, crowding out the low-productive workers may not be very costly in terms of foregone production. Second, to the extent that the workers who take up disability pensions low skilled, such policy would reduce the relative supply of low skilled workers. This has a positive externality of compressing the skill premium, in line with the argument above.

     Finally, educational subsidies will have the possibility to impact educational investment directly. Such subsidies could mitigate the negative externality of reduced enrolment due to higher progressive taxation. On the one hand, this suggests that a "Scandinavian" policy package could possibly be optimal: highly redistributive taxation to insure against innate ability, coupled with heavy subsidies to education so people still go to college. On the other hand, if people will work less because of progressive taxation then it is potentially more costly to raise revenue to finance educational spending.

Methodology Subproject A2: Inequality and aggregate fluctuations (Violante, Heathcote & post doc 1)

     The purpose of this subproject is to explore how fluctuations in heterogeneity can have aggregate effects, and how these effects influence asset prices and the cost of business cycles.

     Step1: theory. In terms of theory, the subproject builds on the same framework as Subproject A1. The challenge is to allow business-cycle fluctuations and, in particular, to analyze time-varying fluctuations in individual risk, and still retain the analytical tractability of Heathcote et al. (2012). Moreover, it is desirable to extend the model to allow both involuntary unemployment and to develop a model of indivisible labor supply so as to generate endogenous employment. This is an extension also relative to for example Mankiw (1986), Constantinides and Duffie (1996), and Storesletten et al. (2001), who abstracted from endogenous labor supply. It would also facilitate closer comparison with Krusell and Smith (1998), which is essentially a real business cycle model with incomplete markets.

     Step 2: measurement. In terms of quantitative results, a first goal is to estimate how large the systematic fluctuations in insurable and uninsurable risk is over the business cycle. Note that this is different

from fluctuations in the more standard decomposition of permanent versus transitory risk (cf. Meghir and Pistaferri 2004; Storesletten et al., 2004b). This will be done using U.S. cross-sectional data from the Current Population Survey, the Survey of Consumption Expenditures, and the Panel Study of Income Dynamics (PSID). The next step is to assess quantitatively how much this would contribute to aggregate fluctuations.

In terms of analyzing the cost of business cycles, the plan is to derive analytical welfare cost expressions when labor supply is endogenous, and use this framework to revisit the findings of the older literature in a setting with endogenous labor supply and a more realistic process for individual risk, i.e., one where the amount of insurable risk may fluctuate over the business cycle.

In terms of asset pricing, the aim is to explore how the price of risk is affected by endogenous labor supply and potentially different dynamics of insurable and uninsurable individual risk. The aim is to do so without compromising on the analytical characterization of equilibrium and welfare effects of Heathcote et al. (2008, 2012). It would be highly desirable to extend the analysis of Heathcote (2012) to more general specifications for preferences and risk, such as for example Epstein-Zin preferences and long-run consumption risk, which is a popular framework in the modern asset-pricing literature.

Preliminary results suggest that a high Frisch elasticity of labor supply tends to lower the price of risk because a flexible labor supply can serve as an effective vehicle of self insurance. Moreover, it is not the overall inequality that matters, but the dynamics of insurable versus uninsurable risk. Larger uninsurable and smaller insurable risk during recessions would both contribute to a larger risk premium.

Methodology, Subproject B: Human mistakes in macro models (with Yogo and post doc 2)

The aim of this subproject is to introduce a model of bounded rationality in an otherwise standard macroeconomic model with heterogeneity. The purpose is to revisit the design of welfare state policies and, in particular, pension reform, when individuals in the model have limited rationality and make mistakes.

Step 1: the basic model. The starting point will be a multi-period life-cycle model with an explicit model of the welfare state. It is natural to incorporate multi-person households, along the lines of e.g. Attanasio et al. (2008), Hong and Rios-Rull (2007), and Heathcote et al. (2010). Following e.g. DeNardi et al. (2010), the basic model will be extended to incorporate individual risk in terms health expenditures, longevity, and shocks to wages. The model will have two novel features relative to the existing literature. First, people may purchase life insurance, annuities, and insurance against medical expenditure costs (most studies in this literature assume that there are no insurance markets, just a riskfree bond). Second, people will be bounded rational when making the key decisions: savings, labor supply, and insurance purchases.

Step 2: modelling and quantifying bounds on rationality. For simplicity, I will focus on two potential models of bounded rationality: rational inattention (cf. Mankiew and Reis) and costs of adjusting decisions (Chetty et al., 2012). These models abstract from systematic biases in decision making. This seems sensible since DeNardi et al. (2010) argue that on average, people save sufficient for retirement.

The welfare properties of government programs will obviously hinge on the assumed limits to rationality. The key issue will therefore be how to measure the degree of inattention and adjustment costs. I propose a novel approach to achieve this: calibrate the limits on rationality so that the model generates quantitatively the dispersion in purchases of life insurance and annuities, as documented by Koijen et al. (2012).

Step 3: Evaluation of model and of government programs. Once the life-cycle with bounded rationality has been calibrated, it is necessary to verify that it is consistent with other dimensions of heterogeneity not targeted in the calibration. The model has many such predictions related to potential mistakes and heterogeneity. For example, the model will have sharp predictions about the wealth dispersion, over and above the wealth dispersion in a fully rational model. Moreover, the model will feature a delayed behavioral response to policy changes (such as e.g. lower taxes).

As a first pass, the model will be used to evaluate the social security system and to quantify the average and the distributional welfare effects of this program.

Methodology. Subproject C1: Sharing growth: China's welfare state in transition (with Song, Wang, Zilibotti, post doc 3, and graduate student)

The aim of the subproject is to develop a quantitative framework for China that is sufficiently rich to capturing both the macroeconomic development and the demographic changes that matter for the welfare state. The framework will be used to analyze the scope for allowing more people to share the benefits of high future wage growth. This includes potential transfers to rural areas, reforms of the pension system, etc.

Step1: the model. The starting point is a workhorse model in macroeconomics and dynamic public finance, namely the Auerbach-Kotllikoff overlapping generations model. This is a multi-period neoclassical overlapping generations model with endogenous capital accumulation and wage growth, and allows a

detailed description of the fiscal policy, including a tax system, a pension system, and other salient aspects of the welfare state and government consumption. The framework includes a state-of-the-art demographic model capturing the changes in the demographic distribution as well as the internal migration from rural to urban areas. As a first pass, we will model the migration process as exogenous age-dependent emigration rates from rural areas. It would be ideal to be able to extend such exogenous migration model to one where the migration rates respond endogenously to the rural-urban wage gap and to the distance to the city.

The basic model will be calibrated to Chinese data and will embed a number of structural features specific to the Chinese economy, such as for example the rise in employment in private firms and the associated decline of state-owned enterprises. Song et al. (2011) is, to my knowledge, the only model that can account for the salient macroeconomic trends in China over the last two decades. Therefore, we will follow Song et al. (2011) and embed financial and contractual imperfections so as to be able to account for the hitherto Chinese economic development. This subproject will be the first model to consider jointly the demographic evolution and the evolution of future wages and tax base. It is therefore natural to use it as a workhorse to predict future growth in macroeconomic variables such as output, wages, and the foreign surplus. Differently from Song et al. (2011), the new subproject requires also an explicit model of the rural economy.

Step 2: Empirical facts. A key step in the subproject is to derive good measurements of the differences between wages in rural and urban areas, and the degree to which these differences are due to differences in human capital or differences in labor productivity (for a given skill). We will probably take benefit of the Longitudinal Survey on Rural Urban Migration in China (RUMiC). RUMiC consists of three large scale surveys: the Urban Household Survey, the Rural Household Survey and the Migrant Household Survey.

Step 3: Analysis. We have done some preliminary work focusing on the Chinese pension system. This analysis suggests that the current system is unbalanced and requires a significant adjustment, either in the form of a reduction of pension benefits or in the form of an increase in the social security tax. However, since the wage growth is so high, a reform is not imminent. By delaying the necessary adjustment, the future reform will obviously be more painful. However, since future generations are so rich, their welfare loss will be negligible in comparison to the large gains current generations will get if the current unsustainable system is protracted. These results hinge on two key features of China that are equilibrium outcomes in our model: in the medium run the future wage growth will remain high while the rate of return on savings will remain low (currently, annual wage growth is about six percentage points larger than the interest rate on deposits). Intuitively, there is not much point in financial savings when the return on such savings is vastly dominated by wage growth: the future value of savings will be tiny relative to the future wages and the future tax base.

Methodology. Subproject C2:
Trade surplus and currency manipulation (w/Song, Zilibotti, post doc 3, and graduate student)

How could China possibly maintain a severely misaligned real exchange rate for more than a decade, without feeding domestic inflation pressure, e.g., by increasing the demand of non-traded goods and stimulating domestic wage pressure? This subproject aims at taking the currency-undervaluation thesis seriously by building a structural model where the government can enforce strict capital controls and can dictate the nominal currency.

Step 1: the model. In a previous paper, we have proposed an alternative theory for the growing surplus, due to a combination of financial frictions and a transition from inefficient state-owned firms toward efficient private firms (Song et al. 2011). Banks are by assumption stingy with lending to private firms, and as the entrepreneurs accumulate retained earnings, they crowd out the inefficient state-owned firms. Instead of lending domestically, the banks are forced to lend internationally as the state firms evaporate. The model can also explain the low wage growth and the sustained high rates of return on capital in China.

We now want to use some of these ideas to shed light on the domestic inflation and the plausibility of the currency undervaluation thesis. The first step is to extend the previous model with tradable and non-tradable goods, and to allow explicit capital controls. In addition, we will consider potential temporary restrictions on imports and exports, where joining the WTO will be modelled as a reduction in export costs.

Step 2: analysis. The next step is to develop testable implications for prices (of each good), wages, and the industrial structure, under the maintained hypothesis that the exchange rate is manipulated. One potential candidate for making the currency undervaluation thesis work is the high Chinese savings rate. A key challenge will be to endogenize this high savings rate and to establish the conditions under which capital controls and a manipulated currency can influence the savings rate. Indeed, the savings rate is particularly puzzling in light of the fact that current workers can expect a future wage growth much larger than the rate of return on standard assets for private savings such as bank deposits and bonds.

Step 3: Assemble empirical facts. Ultimately, this subproject will hinge on the empirical results and this will be the main focus of the subproject. In terms of data requirements, the subproject requires assembling various sources of available aggregate data (through for example yearbooks from the various government ministries and provinces), in order to uncover relative price movements regionally and in China as a whole. We will also make extensive use of micro data in order to construct good series for wage growth. Through Zheng Song (Chicago Booth) we have access to the best Chinese panel data on household composition and earnings and to the BES panel data on firms in manufacturing and construction (the data covers all Chinese firms with sales above one million dollars).

Step 4: The ultimate test of the undervaluation thesis is to evaluate if the model predictions are consistent with empirical trends in relative prices, inflation, wages, and changes in the industrial structure. A successful account of these facts can be an important input to this relevant policy debate. A failure to account for the data may suggest that the undervaluation thesis is misguided. It may also indicate new directions for understanding the Chinese surplus.

Methodology:. Subproject C3: Regional growth disparities in China
(with Loren Brandt, Gueorgui Kambourov, post doc 3, and graduate student)

Empirical strategy: The first step in this subproject is to establish key empirical facts and to obtain an understanding of what empirical factors matter for regional growth. However, it is necessary to go beyond the province-level data used by previous researchers because there are only 31 provinces, which makes it difficult to discriminate between potential theories. To make progress, the plan is to construct a panel data set for nearly 300 prefectures in China. These data cover GDP, population, industrial structure, ownership structure, infrastructure, etc. over major portions of the period 1980-2008. The data set will be constructed by combining prefecture level data that begin in 1990, with data from the manufacturing census and annual survey of large manufacturing firms starting in 1998 (National Bureau of Statistics), and the population census data (for the years 1982, 1990, 1995, 2000, 2005, and 2010).

The first aim is to establish the extent to which initial conditions (in terms of SOE presence) influences subsequent growth of DPE on a prefecture basis, as well as subsequent population growth and TFP growth. We will also explore in what sectors the DPEs expanded and how this expansion relates to the initial SOE employment structure. Moreover, we will examine if the level of government ownership – local, province, or state – matter for subsequent growth.

Developing theory: An important aim of the subproject is to provide a testable theory for the disparities in growth in China and, ultimately, to identify the important distortions preventing growth. The empirical insights into what accounts for regional growth will guide us in formulating theories explaining the regional growth differences. We have in mind three classes of theories: geographically determined productivity, resource monopolies/cronyism, and culture.

Geographical productivity differences (infrastructure): Rappaport and Sachs (2003) ague that access to waterways increases productivity, and have identified this as a key factor explaining regional industrial growth in the US. Before 1980 the Chinese transportation system over land was limited to a modest rail network. After economic liberalization, the economy grew, but the coastal regions had the advantage that they could transport at sea, which only required a port. As it turns out, large cities in internal regions also have good access to transportation both through for example the Yangtze River and through railway systems. This variation will allow us to isolate the role of waterway access.

Resource monopoly: SOEs may have exclusive rights to critical resources such as electricity, bank loans, or skilled personnel. Authorities are sensitive to the demands of the SOE and ensure that they receive the resources needed to survive (note that promotion and support of the SOEs may be important to career of bureaucrats). As a consequence, authorities may restrict business licenses for competing firms, and they might also try to pressure the resource suppliers to discriminate against the DPEs. With a large presence of SOEs, these resources are effectively monopolized, which makes it difficult for new firms to appropriate the resources necessary for operation. Conversely, if the SOEs were initially small, so that collective enterprises (COE) and foreign enterprises (FE) had a large share of urban employment, then SOEs will only control a small amount of the resources and entering firms can gain lots of resources by outcompeting COEs and FEs. In this case private firms should expand in sectors which use different resources than the local SOEs. Moreover, the expansion of private enterprises should depend on the initial local (prefecture) share of SOEs and not on the region per se.

Culture and entrepreneurial spirit: Perhaps the lack of growth of private firms in interior regions has cultural roots in the sense that people in some areas lack "entrepreneurial spirit" while this cultural trait is abundant elsewhere. In our view it is natural to consider cultural traits as relatively uniform over large areas,

encompassing many cities. Thus, if culture were the main driver of private firm growth, then there should be very little within-province variation and province fixed effects should pick up most of the overall variation.

Methodology, Subproject C4: Dynamic political economy (with Song, Zilibotti, and post doc 4)

Subproject C4 will continue my research agenda on dynamic political economy, with a focus on government debt and intergenerational conflict. Macroeconomics is scant on theories of government debt. Given this large recent public interest in government debt accumulation, there is a strong need for progress in this area. In a previous paper (Song et al., 2012) we develop one such theory of government debt and fiscal policy, driven by a conflict between the old and the young. Each period the fiscal policy – public good provision, taxes, and government debt – is determined in an election. A key finding of that paper is that the repeated political conflict tends to mitigate government debt: the young forecast the reaction of future governments to increased debt. Since this reaction entails – in equilibrium – a somewhat lower public good provision, the young become weary about debt. This induces fiscal discipline.

We want to extend this work in several directions. First, we will embed the theory in a full general equilibrium setting, using methods from Aiyagari (1994) and part A1 above. Second, we will introduce country-specific shocks to fiscal policy (e.g., wars) as well as political shifts to the left or to the right. This yields testable predictions of how fiscal policy and, in particular, government debt responds to expenditure shocks and political shifts. Moreover, the theory will generate a world distribution of government debt. Finally, we aim at allowing the possibility of sovereign default in order to study the interaction between political conflict and constraints imposed by the financial lending markets.

More in general, this subproject aims at understanding what – if anything – may sustain the pension systems and prevent governments from choosing ever-increasing government debt. One lead we will investigate is if fiscal policies may be complements to other policies: voters who know the future government must repay a large debt may strive to increase the tax base through educational subsidies and business-friendly policies.

Summary

This project aims at improving structural macroeconomic models with individual heterogeneity and micro-based individual behavior so as to study theoretical and empirical aspects of inequality and economic development, including the rapid transformation of China. The ultimate aim is to contribute to making these models everyday tools in macro, development/labor economics, and actual policy making. A key theme is the use and effectiveness of government redistribution policies to deal with cross-sectional inequality.

A positive externality of the project will be to strengthen and consolidate macroeconomics in Norway and Europe. Norway has fallen behind the US in this field, and bringing post docs to Oslo provides a gateway to hire top candidates as professors in some years.

Intermediate stages and milestones:

I now describe some milestones of the research project, visualized in the diagram below.
- A1 will be started immediately with some data collection. I expect that the draft of at least one paper will be available within month 30. After that, follow-up subprojects will be developed. Drafts should be ready by month 60. An international conference on inequality in macro will be arranged within the first 24 months.
- A2 will be developed during the months 12-36. One academic paper will be completed by month 36.
- Subproject B will be developed in months 12-60, with a draft of at least one paper by month 36 and potential follow-up work during the months 37-60.
- C1 will be started immediately. I plan to organize a conference on China and economic policy during the first 36 months. The conference should gather the leading researchers working on China. A draft of the first paper will be available within month 30. Over the remaining months I will develop follow-up subprojects, with the aim of completing several additional papers by month 60.
- C2 will be started by month 24. The first six months will focus on data collection. The draft of at least one paper will be ready by month 54.
- C3: in the first 12 months I will focus on examining available data sources. The main work will be started by month 12, with a focus on using data and establishing empirical findings during months 12-24. The main theoretical analysis will be carried out in the months 24-48.
- C4 will start immediately. The draft of a paper will be ready by month 18, with follow-up work thereafter.

Gantt chart - Intermediate stages and milestones

Legend: Data collection · First draft · Follow-up work
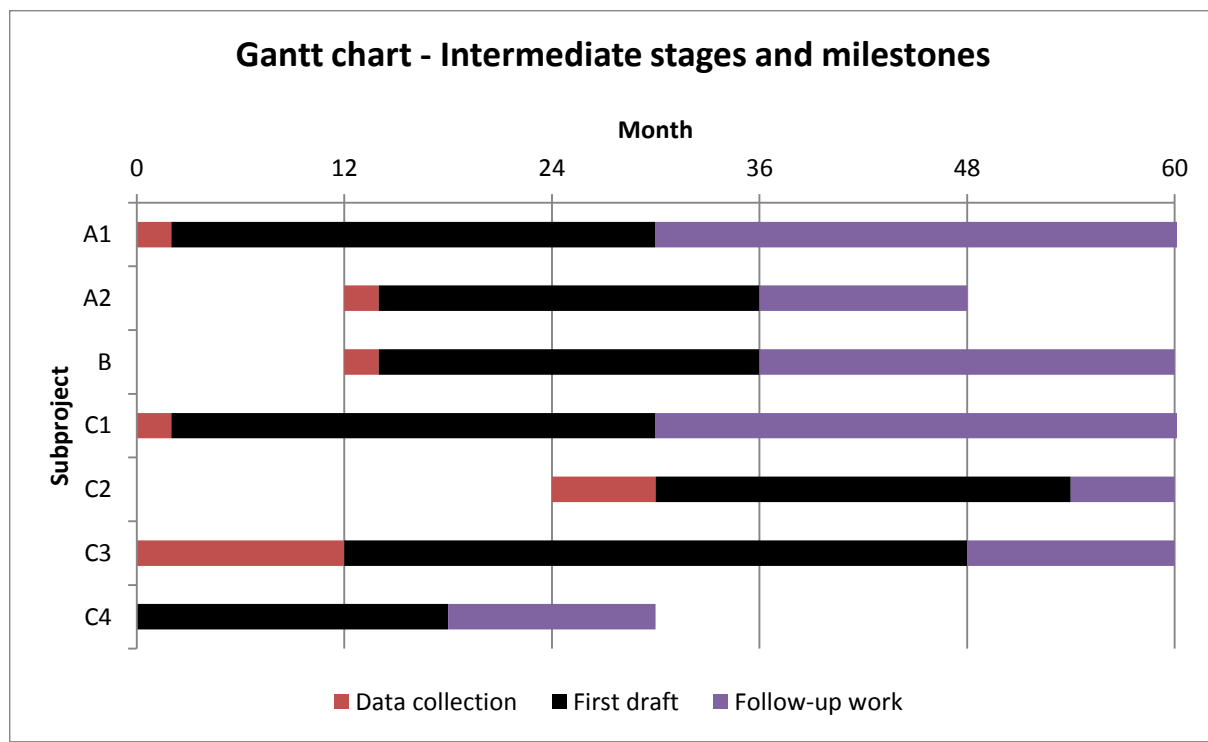
c. Resources (incl. project costs)

All personnel, including all senior researchers and the ones named below, will be directly employed by the HI for the work they contribute to the project. The ERC funding will allow the PI to establish a strong research group in quantitative macroeconomics in Oslo. The core of this group will be the PI, the four post docs hired by the project, the junior researcher, and the senior researchers in part time positions. The personnel costs are:

The PI, Kjetil Storesletten, requires no salary cost for five years. His salary will be covered by the Department of Economics (DoE). He will devote at least 40% of his time to the project.

Three post docs will work on the project full time for four years each, and one post doc will work on the project full time for one year. DoE will finance 25 % of the post docs. This will finance the (light) teaching load imposed on post docs (about one course annually). Given the success of DoE in hiring over the last years (e.g., Harstad from Northwestern and Leuven from ENSEAE, Paris), we will be able to attract highly qualified candidates on the international job market.

Post doc 1 (tied to subproject A1-A2) will contribute with econometrics and programming for the quantitative part of subprojects A1-A2. He/she will also contribute to the many follow-up papers that we expect will be derived from this project.

Post doc 2 (tied to subproject B) will be doing the heavy lifting in terms of programming and solving the model. This is a crucial part of this project. He/she will also be working on some of the many follow-up subprojects that will come out of this project

Post doc 3 and graduate student (both tied to subproject C1-C2-C3) will contribute with programming, analysis, and empirical work for all the subprojects on China. There is substantial work to be done on these subprojects and their natural follow-up projects, and the post doc and grad student are essential to ensure its success. The project covers three years of funding for the grad student. DoE will cover the remaining time.

Post doc 4 (tied to subproject C4) will contribute with theoretical analysis and programming on the dynamic political economy project. This work will cover roughly 12 months.

Research Assistance: the team requires some research assistance and we have budgeted on assistants in equal to 40 % positions (for all five years) that will assist with simple research-related tasks such as e.g. data work, checking references, etc. The research assistants will work with the PI and the post docs on all subprojects.

Senior researchers (travel costs plus equal to three 10 % positions): The project will also benefit from a strong **network of outstanding international researchers** who will be directly tied to the project. Zilibotti is already a part-time professor at University of Oslo, where he spends 2-4 weeks per year. Heathcote, Violante, Zheng Song, Yogo, Wang, and some additional economists, will also be tied to the

group as research affiliates, to the extent this is required to ensure the success for the project. The aim is that each of these senior researchers will spend at least two weeks annually at DoE, contributing to the project.

Visiting program: To ensure the success of the project, it is necessary for the core group to maintain close ties with leading researchers who are experts on the fields relevant for the project, but who are not part of the core group (i.e., outside of the local and the international team). Such a visiting program will achieve two aims that are critical for the project to realize its potential: (1) it will give the core group valuable feedback on the various subprojects; (2) it will stimulate academic research and scientific communication around the project theme and, in particular, help disseminate the scientific progress and new insights generated by the project; and (3) it will enable the group to stay in contact with the research community. The dissemination of the scientific results is especially relevant for subprojects C1-C2-C3 where we intend to establish strong links to economists and policy makers in China. The project will cover travel costs and in some cases a per diem. This is a very cost effective way of building the group and propelling the project. 12,000 is allocated annually to the visiting program. These costs are recorded as "Travel cost for Visiting Partners" in the budget below. In the line "Travel cost for Visiting Partners we have also put the travel cost for participants in the two conferences that will be organized for the project.

International team: Here is a description of the international team:

Violante is a full professor at NYU. He is a leading macroeconomist of his generation. He has published in all the top five journals in economics (QJE, JPE, Econometrica, AER, and REStud).

Heathcote is a senior economist at FRB Minneapolis. He is a leading macroeconomist who has published in JPE, REStud, and top field journals. Heathcote and Violante are essential contributors to subprojects A1-A2. These projects are a continuation of our previous joint projects. Each coauthor brings unique skills to the team in terms of programming, econometrics, and mathematical analysis.

Zilibotti is a chaired professor at University of Zurich. He recently won the Yrjö Jahnsson Prize for the best economist under 45 in Europe. He is a prolific writer and has published heavily in the top-3 journals.

Song is an assistant professor at University of Chicago. Among Chinese nationals, he is the most promising macro economist in the world. He has published in AER and IER.

Wang is a PhD fellow at Univ. of Zurich (visiting MIT). He is an expert on numerical methods.

Zilibotti, Song, and Wang are essential contributors to subprojects C1-C2 and C4. These projects build on our previous joint projects. Each coauthor brings unique skills to the team in terms of programming, econometrics, analysis, and access to Chinese data (Song).

Yogo is a monetary advisor at Minneapolis Fed. He has published in top journals (JPE, JF, JFE). He commands skills in finance, econometrics, and health econ. These are critical for the success of subproject B.

Kambourov is a professor at Univ. of Toronto. He is an influential young economist who has published in top-5 journals. He contributes key skills in macro, trade, and labor to subproject C3.

Brandt is a professor at Univ. of Toronto. He is a leading scholar on China. He brings key Chinese data and essential empirical skills to subproject C3 and its many potential follow-up subprojects.

Finally, a key challenge for subproject C1-C3 is to get the attention of Chinese policy makers. Given their network in China, Brant and Song are in an excellent position to deliver such network.

Local network in Oslo: The new macro group will also benefit from the strong group in labor economics and economic theory at ESOP (Univ. of Oslo). Some of those who will contribute to the project are:

Bård Harstad (Univ. of Oslo) was hired from Northwestern in 2012, where he was a chaired professor. He has already four articles in top-5 journals. Harstad's expertise is political economy and economy theory, and he will be particularly useful for project C4 (Dynamic Political Economy)

Karl Moene (U. of Oslo) has made major contributions to institutional economics and wage bargaining, and has published in top-3 journals. He will contribute to subprojects A1 and B.

Edwin Leuven was hired at Univ. of Oslo in 2011. He is a prolific author in labor economics and has published in top-3 journals. He will contribute to subproject A1.

Travel: The budget allocates on average 18,562 annually to cover travel costs. This comes in addition to the costs for the visiting program and conferences described above. This will fund travel for the part of the team based in Oslo, so the PI and post docs can travel to conferences and travel to work with co-authors on the project. It will also fund travel costs for the international team (paid by the HI) described above to visit Oslo.

Conferences: I plan to organize two conferences (see "Milestones" for details). We are organizing the conferences ourselves, so there will be no subcontracting involved.

Data sets: The budget allocates 2000 annually for costs associated with empirical work (such as purchasing data sets). This is recorded as part of Consumables.

iii. Budget - Table 1

		Please enter duration in months ==> :	60			

		Cost Category	month 1 to 18	month 19 to 36	month 37 to 54	month 55 to 60	Total
	Personnel:						
	P.I.		-	-	-	-	-
	Senior Staff		53 036,00	55 284,00	57 628,00	20 024,00	**185 972,00**
	Post docs		217 895,00	385 005,00	303 649,00	97 391,00	**1 003 940,00**
	PhD		35 705,00	121 364,00	87 712,00		**244 781,00**
	Students		40 376,00	42 801,00	44 616,00	16 278,00	**144 071,00**
	Other						-
	Total Personnel:		**347 012,00**	**604 454,00**	**493 605,00**	**133 693,00**	**1 578 764,00**
Direct Costs:							
	Other Direct Costs:						
	Equipment		-	-	-	-	-
	Consumables		3 000,00	3 000,00	3 000,00	1 000,00	**10 000,00**
	Conferences		6 400,00	11 400,00			**17 800,00**
	Travel cost for Visiting Partners		30 750,00	40 750,00	18 000,00	6 000,00	**95 500,00**
	Travel		24 914,00	28 384,00	28 479,00	9 198,17	**90 975,17**
	Audit Certificate		1 000,00	1 000,00	1 000,00		**3 000,00**
	Publications		-	-	-	-	-
	Total Other Direct Costs:		**66 064,00**	**84 534,00**	**50 479,00**	**16 198,17**	**217 275,17**
	Total Direct Costs:		**413 076,00**	**688 988,00**	**544 084,00**	**149 891,17**	**1 796 039,17**
Indirect Costs (overheads):	20% of Direct Costs		82 415,20	137 597,60	108 616,80	29 978,23	**358 607,83**
Subcontracting Costs:	(No overheads)		-	-	-	-	-
Total Requested Grant:	(by reporting period and total)		**495 491,20**	**826 585,60**	**652 700,80**	**179 869,40**	**2 154 647,00**

For the above cost table, please indicate the % of working time the PI dedicates to the project over the period of the Grant :	40,00 %

iii. Budget - Table 2

,,key intermediate goal", as defined in section 2.	Estimated % of total requested grant	Expected to be completed on month :	Comment
A1	15 %	30	
Follow-up work on A1	5 %	60	
A2	6 %	36	
Follow-up work on A1	6 %	60	
B	10 %	36	
Follow-up work on B	10 %	60	
C1	18 %	30	
Follow-up work on C1	5 %	60	
C2	7 %	54	
Follow-up work on C2	2 %	60	
C3	8 %	48	
Follow-up work on C3	2 %	60	
C4	5 %	18	
Follow-up work on C4	1 %	60	
Total	**100 %**		

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d. Ethical and security-sensitive issues

ETHICS ISSUES TABLE

Areas Excluded From Funding Under FP7 *(Art. 6)*

(i)   Research activity aiming at human cloning for reproductive purposes;

(ii)   Research activity intended to modify the genetic heritage of human beings which could make such changes heritable (Research relating to cancer treatment of the gonads can be financed);

(iii) Research activities intended to create human embryos solely for the purpose of research or for the purpose of stem cell procurement, including by means of somatic cell nuclear transfer;

All FP7 funded research shall comply with the relevant national, EU and international ethics-related rules and professional codes of conduct. Where necessary, the beneficiary(ies) shall provide the responsible Commission services with a written confirmation that it has received (a) favourable opinion(s) of the relevant ethics committee(s) and, if applicable, the regulatory approval(s) of the competent national or local authority(ies) in the country in which the research is to be carried out, before beginning any Commission approved research requiring such opinions or approvals. The copy of the official approval from the relevant national or local ethics committees must also be provided to the responsible Commission services.

Research on Human Embryo/ Foetus	ES	Page
Does the proposed research involve human Embryos?		
Does the proposed research involve human Foetal Tissues/ Cells?		
Does the proposed research involve human Embryonic Stem Cells (hESCs)?		
Does the proposed research on human Embryonic Stem Cells involve cells in culture?		
Does the proposed research on Human Embryonic Stem Cells involve the derivation of cells from Embryos?		
I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROPOSAL	X	

Research on Humans	ES	Page
Does the proposed research involve children?		
Does the proposed research involve patients?		
Does the proposed research involve persons not able to give consent?		
Does the proposed research involve adult healthy volunteers?		
Does the proposed research involve Human genetic material?		
Does the proposed research involve Human biological samples?		

	Does the proposed research involve Human data collection?		
	I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROPOSAL	X	

Privacy		**ES**	**Page**
	Does the proposed research involve processing of genetic information or personal data (e.g. health, sexual lifestyle, ethnicity, political opinion, religious or philosophical conviction)?		
	Does the proposed research involve tracking the location or observation of people?		
	I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROPOSAL	X	

Research on Animals[2]		**ES**	**Page**
	Does the proposed research involve research on animals?		
	Are those animals transgenic small laboratory animals?		
	Are those animals transgenic farm animals?		
	Are those animals non-human primates?		
	Are those animals cloned farm animals?		
	I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROPOSAL	X	

Research Involving non-EU Countries (ICPC Countries[3]) [4]		**ES**	**Page**
	Is the proposed research (or parts of it) going to take place in one or more of the ICPC Countries?		
	Is any material used in the research (e.g. personal data, animal and/or human tissue samples, genetic material, live animals, etc) : a) Collected in any of the ICPC countries?		
	b) Exported to any other country (including ICPC and EU Member States)?		
	I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROPOSAL	X	

Dual Use		**ES**	**Page**
	Research having direct military use		
	Research having the potential for terrorist abuse		
	I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROPOSAL	X	

If any of the above issues apply to your proposal, you are required to complete and upload the "B2_Ethical Issues Annex" (template provided).

Without this Annex, your application cannot be properly evaluated and even if successful the granting process will not proceed.

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[2] The type of animals involved in the research that fall under the scope of the Commission's Ethical Scrutiny procedures are defined in the Council Directive 86/609/EEC of 24 November 1986 on the approximation of laws, regulations and administrative provisions of the Member States regarding the protection of animals used for experimental and other scientific purposes Official Journal L 358 , 18/12/1986 p. 0001 - 0028

[3] In accordance with Article 12(1) of the Rules for Participation in FP7, 'International Cooperation Partner Country (ICPC) means a third country which the Commission classifies as a low-income (L), lower-middle-income (LM) or upper-middle-income (UM) country. Countries associated to the Seventh EC Framework Programme do not qualify as ICP Countries and therefore do not appear in this list.

[4] A guidance note on how to deal with ethical issues arising out of the involvement of non-EU countries is available at: ftp://ftp.cordis.europa.eu/pub/fp7/docs/developing-countries_en.pdf

Please see the Guide for Applicants for the Advanced Grant 2012 Call for further details and CORDIS http://cordis.europa.eu/fp7/ethics_en.html for further information on how to deal with Ethical Issues in your proposal.