1. Overview

Economists have long speculated on why productivity and growth varies so spectacularly across countries, firms and time. For example, labor productivity varies by up to 10 fold across countries, up to 100% across establishments within the same 5-digit industry sector, and by several percent over the business cycle. The aim of this proposal is to apply micro-to-macro empirical and simulation analysis to try to understand the causes of these differences. This research question is also a key issue for policymakers, since ensuring growing standards of living relies on continued productivity growth. This is as important in developing countries as in the US - for example, the rapid productivity growth of Chinese manufacturing since 1978 has been an important factor in lifting around 300 million people out of poverty. This career proposal will investigate the micro factors behind macro productivity and growth in three areas:

- **Uncertainty and recessions:** This looks at the potential role of increased uncertainty in driving recessions by reducing hiring, investment and productivity-enhancing reallocation. The idea is that the rise in uncertainty during recessions will make firms cautious about hiring and investment, cutting the aggregate labor force and capital stock. But this will also reduce the reallocation of factors of production across firms, since productive firms will be more cautious about expanding and unproductive firms more cautious about contracting. Since reallocation appears to drive the majority of aggregate productivity growth, uncertainty could play a large role in driving business cycles. Understanding this is a key policy issue - if uncertainty drives recessions it will also reduce the impact of monetary and fiscal policy during recessions, because uncertainty will also make firms more cautious in responding to interest rate and tax changes.

- **Management practices:** The second will look at management practices in shaping productivity levels in firms. Business people, policymakers and the media have long claimed that management practices play a key role in driving firm productivity. For example, the 1947 Marshall Plan mission to Europe reported “efficient management was the most significant factor in the American [productivity] advantage”\(^1\), a view that many still share half a century later (e.g. Lewis, 2004). But empirical economists have had relatively little to say because of the absence of good management data. The proposal will use a new double-blind management survey instrument developed in Bloom and Van Reenen (2007) to help to build a systematic evidence base on management practices. Using this cross firm, industry and country data I will investigate which factors are associated with better management practices, and ultimately which policies may help to improve productivity.

- **Trade and technology:** The third will look at the role of increasing Chinese trade competition in driving productivity growth through innovation and the adoption of information technology (IT). The rise of Chinese exports has been generating intense debate over the impact of trade competition and the desirability of a protectionist policy response. Many commentators have also linked this to the rapid increase in wage-inequality in the US and much of Europe (e.g. Krugman (2007) or OECD (2007)). But the effects of these are difficult to evaluate because of the lack of internationally comparable micro-data. This proposal will build a new US and European firm database on employment, innovation and IT and use this to directly quantify the impact of Chinese imports on innovation, productivity and growth.

\(^1\)See Dunning (1958)
2. Uncertainty and reallocation

In the standard Real-Business Cycle (RBC) literature, recessions are caused by large negative technology shocks. With the exception of the oil price shocks, however, it is difficult to identify negative technology shocks that are large enough to cause recessions. As King and Rebelo (1999) ask in their seminal paper, “If these shocks are large and important, why can’t we read about them in the Wall Street Journal?” An alternative explanation is put forward in Keynesian models of the business cycle, which suggest that recessions are often driven by monetary and fiscal policy shocks. But again, identifying many of these empirically has proven to be challenging - for example the three recessions since the early 1990s do not seem to be accompanied by any gross policy mistakes (Hall, 2007). Hence, the major question remains: where are the shocks that drive the business cycle?

An alternative explanation is that uncertainty could be driving part of the business cycle. The intuition is that if uncertainty rises in recessions this could cause a rapid slow down in economic activity. When uncertainty is high the adjustment costs for changing labor and capital inputs make firms cautious in hiring and investing. If it is expensive to hire a worker and then fire them again, or buy a piece of equipment and then sell it again, it makes sense to pause activity when uncertainty is temporarily high.\(^2\) Of course if every firm in the economy waits when uncertainty rises then the labor force and capital stock will fall from attrition (retirement, maternity, sickness etc.) and depreciation. Moreover, productivity growth rates will also fall when uncertainty rises. The reason is recent empirical work has shown that around three quarters of US productivity growth is due to the reallocation of output from low to high productivity firms (Foster, Haltiwanger and Krizan 2004 and 2006).\(^3\) Since higher uncertainty will deter productive firms from expansion or entry and unproductive firms from contraction or exit, this will freeze the process of reallocation. Hence, a rise in uncertainty could generate a business cycle by reducing hiring, investment and productivity growth.\(^4\)

The general idea that links uncertainty to the business cycles is not new. John Maynard Keynes argued that changes in investor sentiment, the so-called animal spirits, could lead to economic downturns. While this can be interpreted as an argument for the role of uncertainty, it has not traditionally played a large role in the theory of business cycles for two reasons. First, evidence on time series variation in uncertainty is scarce. The behavior of levels of variables over the business cycle (the first moment) is well documented, but the dispersion of these (the second moment) is much less well understood. Second, models with time varying uncertainty are theoretically challenging. In macroeconomics, the standard analytical and numerical solution techniques used in the RBC literature do not apply in this setup so few papers have considered uncertainty shocks. One exception is Bernanke (1983), who models a single firm deciding on investment in energy efficient capital in the presence of oil-price uncertainty. He finds that higher uncertainty reduces investment as firms become more cautious. However, this paper is based on a stylized single-firm economy in partial equilibrium.

This career proposal intends to address both the lack of measures of uncertainty over the business cycle, and also to build a new simulation model to extend the RBC framework to allow for heterogenous firms and uncertainty.

---

\(^2\)This is the real-options effect of uncertainty, as discussed in for example Bertola and Caballero (1994), Dixit and Pindyck (1994), Abel and Eberly (1996) or Caballero and Engel (1999).

\(^3\)The recent work on product switching within firms suggests even large parts of the within firm productivity growth may reflect reallocation across product lines (Bernard et al 2007).

\(^4\)Another salient feature of the business cycle is the rapid fall in consumer durable purchases, another prediction of higher uncertainty (see, for example, Romer 1990 or Eberly 1994).
2.1. Measuring uncertainty over time

Figure 1 shows a preliminary quarterly proxy for uncertainty, which I constructed with Max Floetotto and Nir Jaimovich. Measuring uncertainty is not easy, so the proxy in Figure 1 is the principal component factor of a range of different uncertainty measures, spanning cross-sectional firm and industry spreads, forecaster disagreement and aggregate implied and actual volatility. While each of these measures is individually problematic, what is striking is that they on average they rise strongly in recessions (with a correlation with GDP growth of -0.601). This implies a stylized fact, that uncertainty is counter-cyclical. Adding this uncertainty proxy into a standard VAR also generates a U-shaped impulse response function (Figure 2), much like that for a negative TFP shock measured using Basu, Fernald and Kimball (2006) data. Thus, uncertainty appears counter-cyclical and based on the evidence from macro VARs plausibly plays a role in shaping recessions.

To develop more detailed measures of uncertainty I am applying for access to US census, in particular the LBD employment data for around 20 million establishments, and the ASM and CMF data on output and investment data for around 50,000 larger manufacturing establishments. These datasets go back annually to the early 1970s, so allow me to develop micro-measures of industry and aggregate volatility spanning five recessions. For example, I can estimate the rise in uncertainty during recessions by regressing the annual standard-deviation of employment growth rates \( SD_t(\log(N_{i,t})) \) against the share of quarters in recession in that year \( \text{QuartersRecession}_t \). The value of \( \alpha_1/\alpha_0 \) gives an estimate of the typical rise in uncertainty during recessions.

\[
SD_t(\Delta \log(N_{i,t})) = \alpha_0 + \alpha_1 \text{QuartersRecession}_t + \epsilon_t
\] (2.1)

The results from running similar analysis using firm sales and stock-returns data, industry output and TFP data, forecaster unemployment and GDP data, and aggregate output and stock-returns data suggests an increase of uncertainty of between 1/4 and 1/2 during recessions across our uncertainty proxies (see Bloom, Floetotto and Jaimovich 2008). This is true both within and across 3 digit SIC industry sectors, suggesting this increase in uncertainty during recessions is both an increase in the variance of cross-industry shocks and also within industry idiosyncratic shocks.\(^5\)

2.2. Modelling uncertainty shocks

To evaluate whether fluctuations in uncertainty of this magnitude are quantitatively significant I will also build a micro-macro simulation model. The idea is to represent the economy as being composed of a representative consumer and a large number of firms. Each firm faces a productivity process \( (A_t = A_t^M \times A_t^F) \) which is comprised of a common macro term \( A_t^M \) and an idiosyncratic firm-level term \( A_t^F \), with these taking the following stochastic processes

\[
A_t^M = \rho^M A_{t-1}^M + \sigma_t^M \omega_t^M, \quad \omega_t^M \sim N(0,1) \tag{2.2}
\]

\[
A_t^F = \rho^F A_{t-1}^F + \sigma_t^F \omega_t^F, \quad \omega_t^F \sim N(0,1), \text{ I.I.D. across firms and independent of } \omega_t^M \tag{2.3}
\]

In this set-up a standard first-moment macro shock would be modelled by a draw to \( \omega_t^M \), which recent papers such as Kahn and Thomas (2003 and 2008) and Bachman, Caballero and Engel (2006) have investigated. I would extend this literature by also allowing for a second-moment shock modelled by increases in \( \sigma_t^M \) and \( \sigma_t^F \).

This rise in the uncertainty could be thought of as an exogenous impulse, for example the increase in uncertainty after the OPEC I and II oil shocks, the Gulf Wars or the 9/11 attack. Or the rise

\(^5\)This cross industry increase in the variance of shocks during recessions is consistent with the results of Lillien (1982) and Davis (1987). The within industry increase in variance of idiosyncratic shocks addresses the critique of Abrahams and Katz (1986) that this rise in uncertainty during recessions is just the heterogeneous response across industries to common macro shocks. Davis et al. (2006) also looked at long-run volatility trends.
Figure 1: Uncertainty is higher in recessions

Notes: Uncertainty proxy defined as principal component factor on seven quarterly measures of uncertainty: inter-quartile range of firm-level sales growth and stock returns, interquartile range of industry-level output growth, the average conditional standard-deviation of aggregate monthly industrial production, the implied volatility of aggregate stock-returns, and the forecast-spread of unemployment and of GDP. Gray-shading denotes recessionary periods, as dated by the NBER business cycle dating committee.

Figure 2: VAR estimation of the impact of a ‘recessionary increase’ in uncertainty on GDP

Notes: A ‘recessionary increase’ in uncertainty is a 33% increase in the uncertainty index. This is calibrated to the average increase in the uncertainty index (plotted in Figure 1) during a recession. VAR is a Cholesky orthogonalized on quarterly data from 1968:4 to 2004:3 using 4 lags. Dotted lines in top and bottom figures are the 95% confidence intervals. Variables (in order) are log real GDP, log employment, hours, log wages, log CPI, federal funds rate, Basu & Fernald (2006) TFP, the uncertainty index and log S&P500 levels. Detrending by Hodrick-Prescott filter with smoothing parameter of 1600.
in uncertainty could be thought of as an amplification mechanism following an initial first moment shock. For example, in search models such as Diamond (1982) a negative first moment shock will typically reduce agents search activity, lowering information flows and increasing uncertainty.

Either way, a rise in uncertainty could play an important contributory factor in driving recessions which the model will attempt to quantify. This is important because if uncertainty is a factor driving recessions it will also influence the impact of policy responses. When uncertainty is high firms will be more cautious in responding to monetary and fiscal policy, so that much larger stimulus will be needed to induce the same effect. In prior analysis of UK firm level data, Bloom et al. (2007) found an increase in uncertainty from the 25th to 75th percentile was associated with a 50% fall in the responsiveness of firms to demand shocks. Thus, during periods of higher uncertainty - like recessions - interest rate changes would need to be much bigger to induce the same level of response. For example, the large rise in measured uncertainty after the Credit Crunch may have been a factor behind the aggressive 3% cut in interest rates in the following 9 months.

2.3. Empirically identifying first and second moment shocks

The model suggests that at a macro level the impact of first and second moment shocks will look similar - a drop and rebound in hiring, investment and productivity growth. This appears consistent with actual VAR data. To distinguish between these two channels the model also suggests an additional testable prediction of uncertainty business cycles. When uncertainty is high firms will be more cautious in responding to productivity shocks than when uncertainty is low. So employment growth ($\frac{\Delta L_{i,t}}{L_{i,t}}$) and investment ($\frac{I_{i,t}}{K_{i,t}}$) responses to productivity shocks ($\frac{\Delta A_{i,t}}{A_{i,t}}$) should be pro-cyclical in micro-data. This implies, for example, that if hiring and investment regressions were estimated each year on cross-sectional establishment data, the $\beta_t$ and $\gamma_t$ coefficients below should be pro-cyclical

$$\frac{\Delta L_{i,t}}{L_{i,t}} = \alpha_t + \beta_t \frac{\Delta A_{i,t}}{A_{i,t}} + \epsilon_{i,t}^L \tag{2.4}$$

$$\frac{I_{i,t}}{K_{i,t}} = \theta_t + \gamma_t \frac{\Delta A_{i,t}}{A_{i,t}} + \epsilon_{i,t}^I \tag{2.5}$$

In contrast a model of business cycles relying solely on first-moment shocks would yield roughly stable $\beta_t$ and $\gamma_t$ coefficients. (although a pro-cyclical average value of $\frac{\Delta A_{i,t}}{A_{i,t}}$). This provides an additional micro-data approach to try to quantify the relative importance of first versus second moment shocks in driving business cycles, which I will investigate in the US Census data.

3. Management practices

Economists since Adam Smith have suggested that differences in management play an important role in determining firm and national productivity. But while the popular press and Business Schools have long discussed the importance of management practices, empirical economists have had little to say. A major problem has been the absence of high quality data measured in a consistent way across countries and firms. As a result the field of empirical management research has been dominated by case-studies. This career development plan would seek to develop and analyze a large-sample cross firm, industry and country database using a new survey tool for measuring management practices.

3.1. Measuring management practices across countries

Along with John Van Reenen I have developed a new management survey technique based on double-blind surveys, which tries to obtain unbiased responses to management survey questions. One part of this double-blind methodology is that managers are not told they were being scored during the
telephone survey. To run this “blind” scoring we introduce the exercise as an interview about management practices, using open questions (i.e. “can you tell me how you promote your employees”), rather than closed questions (i.e. “do you promote your employees on tenure [yes/no]?”). Furthermore, these questions target factual descriptions of actual practices and examples, with the discussion continuing until the interviewer can make an accurate assessment of the firm’s practices based on these examples. This enables scoring to be based on the interviewer’s evaluation of the firm’s actual practices, rather than their aspirations, the manager’s perceptions or the interviewer’s impressions.

The other part of this double-blind methodology is that our interviewers are not told in advance of the performance of the firms they are surveying. They are only provided with the firms’ name, telephone number, industry and size. Since the sample is medium-sized manufacturing firms our interviewers will have rarely heard of them. So they undertake the interview without any preconceptions on the firm’s management practices.

Firms management practices are scored on a 1 to 5 scale across 18 questions. These questions span three dimensions: monitoring, (tracking of performance, reviewing performance and continuous improvement), targets (the transparency, realism, interconnection and time-horizon of targets) and incentives (the importance of performance in promotion, pay and retention). The overall management score is an average across the 18 questions, so that an average score of 1 indicates a firm with almost no monitoring, very weak targets and no performance incentives, while a score of 5 indicates a firm with continuous monitoring and improvement systems, tough, realistic and transparent targets, and a strong performance link in pay and promotions.

I have organized two management survey waves in 2004 and 2006 targeting plant managers in manufacturing firms randomly drawn from the population of all (public and private) firms with between 100 and 5000 employees in 12 countries (China, France, Germany, Greece, India, Italy, Japan, Poland, Portugal, Sweden, UK and the US). This covered around 5000 firms, taking an average of 45 minutes per interview with a population response rate of about 44%. This high response rate was achieved by using high quality interviewers (typically MsC or MBA students), providing them with 3 days of interview training, and supporting them with 21 endorsement letters from Central Banks, Governments and employers organizations.

Of course one question is how reliable are these surveys? While the double-blind methodology is designed to try and collect accurate management data on firms, it may still fail in practice. So to evaluate the survey we ran two validation exercises. First, we resurveyed about 5% of the sample (222 firms) using a different interviewer to talk to a different plant manager in the same firm. This provides a second completely independent measurement of management practices within the firm. Comparing the average scores across the two independently run surveys on the same firm we find a correlation of 0.627, suggesting our management scores are consistently picking up differences in management practices across firms. Second, we took our management scores and compared them to independently collected performance measures from company accounts. We find management scores are positively correlated with firm-level productivity, profitability, growth rates, survival and Tobin’s Q (for quoted firms only). While these results imply nothing on the causality between management practices and firm performance, they do suggest these management scores are significantly related to firm performance.

This career proposal would develop this work in several ways. First, it would analyze this new data to understand the causes of differences in management practices across firms and countries; second it would support resurveying the original firms to look at the changes in management practices over time, and third it would support extending the survey to different countries and industries.

### 3.2. Explaining why management varies across countries

In Figure 3 I plot the average management score across the 12 countries that have already been surveyed. As can be seen, US medium-sized manufacturing firms are the “best” managed on average,
Figure 3: Country Level Average Management Scores

Mean of management scores for various countries:
- US
- Germany
- Sweden
- Japan
- Italy
- UK
- France
- Poland
- Portugal
- Greece
- China
- India

Figure 4: Firm Level Management Scores

Distribution of management scores for firms in various countries:
- China
- France
- Germany
- Greece
- India
- Italy
- Japan
- Poland
- Portugal
- Sweden
- UK
- US
while those in Southern Europe, China and India are the “worst” managed on average. These figures look very similar to cross-country GDP figures, so they are not surprising. But this close link to GDP does suggest that differences in management practices across countries could be one factor explaining differences in living standards. For example, China and India may be poorer than the US in part because their management practices reduce productivity.

In Figure 4 I plot the firm-level histogram of management practices on a country level basis. There are several interesting points to note in this. First, this reveals incredible dispersion in management practices across firms within the same country, very much like that for firm-level productivity in US and other country-level datasets (e.g. Bartelsman et al. 2008). Second, the differences in averages across countries are not due to different distributional supports for the practice scores, but due to different densities on a similar support. That is, Indian management practices are worse on average than those in the US because they have a large tail of badly run firms, not because every firm in India is worse managed than every firm in the US. This suggests that a reallocation of labor and capital across firms could play a key role in improving average management practices - if all badly managed firms exited in China and India their average management score would be similar to that of the US. These results are consistent with recent work showing the role of insufficient reallocation in explaining lower Chinese and Indian aggregate TFP (Hsieh and Klenow, 2007). Finally, in almost every country there is an upper tail of extremely well managed firms, so that “good” management appears to be possible even in developing countries.

These results raise several questions about why management practices vary so much across firms and countries. This career proposal intends to use this survey data matched into other datasets to investigate this issue. Some leading candidates from initial data exploration appear to be:

**Competition:** This is measured using trade openness, market profitability (Lerner indeces) and the number of competitors the firms report facing, and is strongly correlate with better management. One question is what is the mechanism by which competition improves management - is it via selection whereby badly run firms exit, is it through forcing badly run firms to improve their management practices, or is it because competition facilitates learning? By collecting multiple cross-sections of data over time and looking at the links between competition, selection and the improvement in management scores over time this project will start to evaluate these different mechanisms.

**Ownership:** Multinationals appears to be well managed on average in every country. That multinationals are well managed is a natural outcome from the selection process determining multinational status - only well managed firms will tend to set-up overseas subsidiaries (e.g. Helpman et al. 2004). But what is interesting about multinationals is that they seem to operate and are well managed in almost every country and industry in the sample. That is, they seem to be able to take their management practices with them abroad to developing countries like China and India. This suggests while difficult local conditions are an impediment to good management practices, they are not a complete obstacle.

On the other hand, family owned firms are typically badly managed in every country, particularly those reporting adopting the traditional *primo geniture* practice of promoting the eldest son to be the CEO. Recent work has highlighted the role of family firms in the US and Europe in lowering productivity. Interestingly, founder run firms are also badly managed on average suggesting that the individuals that are good at setting up firms may often not be the best at running these when they grow to become medium or large organizations. Other interesting ownership groups include Government owned firms (which appear to be extremely badly managed) and private-equity owned firms (which appear to be well managed).

In this career grant I will develop a more detailed database on exogenous factors such as tax, history and regulations which can help to identify the causal impact of different ownership groups on firms management practices.

---

6See for example Bennedsen et al. (2007), Perez-Gonzalez (2006), and Betrand and Schoar (2006).
**Skills:** One of the strongest correlates with high management scores are the shares of workers and managers in the firm with a degree level qualification. There are various interpretations of this, including a causal one whereby highly skilled workers are able to adopt better management practices, and a reverse-causal one whereby skilled workers join well managed firms. In this proposal I will build measures of skills supply across countries and regions using databases like the European Labor Force Survey and the Current Population Survey, and information on the location of universities, to try and gain a more causal perspective on the impact of skills on management practices.

Other factors that are potentially important include labor and product market regulations, tax and trade-union power. Again the career proposal will develop datasets to measure these empirically and attempt to evaluate their causal impact on firm management practices.

Finally, the career proposal will also facilitate extending the cross-country dataset on management practices in two ways. First, to a broader group of countries, adding Brazil, Canada, Ireland and Taiwan in 2009. This will help to provide further identification for factors like labor market regulations, tax and rule of law, which mainly vary across countries. Second, running another management survey wave in 2011 on the same firms from the 2004 and 2006 waves to observe difference in management practices over time. This data will provide direct evidence on the extent to which management practices change over time, and what underlying factors are associated with this. For example, is tougher product competition, lighter labor market regulations or ownership change associated with significant improvements in management practices?

### 3.3. Identifying the causal impact of management on firm performance

An obvious question that arises from the differences in management practices across firms and countries is how much does this cause differences in productivity? If management scores account for 25% of cross firm and country differences in productivity this is obviously more interesting than if they account for 2.5% of these differences. To address this question I am developing field-experiments whereby I can change firms’ management scores and evaluate the impact of this on their performance. This is difficult to do, as these firms typically have several hundred employees so are large and complex organizations. I will describe a few approaches on this below, which are all currently in the pilot or planning stage, and which this career proposal would support me to develop over the next five years.

I am currently working on a project in India to provide free management consulting to a set of textile firms around Mumbai. These firms will be randomly selected from the population of textile firms in Mumbai with 100 to 1000 employees, to provide a randomized treatment and control group. For all these firms we have already collected prior performance information from company accounts\(^7\) and management information using the double-blind survey in Summer 2008. We will also collect operational data directly from the firms themselves on indicators like waste, on-time delivery, rejections, electricity usage, takt time, downtime, labor usage etc.

The management consulting intervention is a six-month “process transformation” which Accenture, the international consulting firm\(^8\), will deliver in Fall 2008. These “process transformations” are standard products delivered by international consulting firms, focusing on improving clients’ operational and HR management practices. This intervention has been funded by the Freeman Spogli Institute, the Kauffman Foundation and the World Bank, and is joint with Benn Eifert (Berkeley),

---

\(^7\)All firms in India are legally required to register their annual accounts with the Registry of Business, a practice very similar to the UK and most of Europe. In India while many small firms avoid doing this (they operate ‘illegally’), almost all manufacturing firms with 100+ employees are registered as they can not avoid detection. This registry provides basic balance sheet, sales and profit information over several years, and is publicly available.

\(^8\)Accenture was selected by from the seven consulting firms which responded to the request for proposals. Accenture’s largest office is in India - where they have over 30,000 consultants - so they have the capability to deliver the large scale consulting required for this project.
David McKenzie (World Bank), Aprajit Mahajan (Stanford) and John Roberts (Stanford). Given the current poor state of management practices in many Indian firms, the belief is this extensive high-quality consulting treatment should be able to improve their management practices. By evaluating these changes in management practices and the associated changes in financial and operating performance, we can start to evaluate the causal impact of management on performance.

I am also working John Van Reenen and Erik Berglof (the Chief Economist at the European Bank of Reconstruction (EBRD)) to develop a similar experiment in Eastern Europe. The EBRD regularly funds business consulting for 50+ employee firms in Eastern Europe, and is prepared to randomize the delivery of this to enable us to evaluate these programs. Again, by collecting prior operational, accounting and management information from the treatment and control firms we can use this to try to identify the causal impact of management on firms performance. I am also following up two other more speculative opportunities. First, talking to the UK Treasury in the UK about running similar randomized management experiments there in conjunction with some of the Regional Development Agencies, and second with Sue Helper (Case-Western) investigating a similar idea involving the Ohio Council of Economic Advisers and the Manufacturing Extension Partnership.

Since these management interventions are difficult and expensive to run, my approach is to try a number of interventions with small samples in different areas to slowly build an evidence base. This career grant would help to support this research agenda over the next five years.

3.4. Management practices in schools and hospitals

A final strand of the grant will extend the management survey methodology to study the public sector. Because of limited longitudinal micro data sets, there has been substantially less research on the productivity of the public sector than the market sector. This career grant would support me in running a survey of several thousand schools and hospitals across the US and Europe in Summer 2010, and the subsequent analysis of this.

I have long been interested in management practices in the public sector after having spent a year working in the UK Treasury in 2001-2002. The UK Government was keen to increase national productivity but was frustrated by the slow pace of productivity growth in the public sector, after the mixed results of a number of reforms of schools and NHS hospitals. So to evaluate the applicability of the management survey in 2006 I ran a pilot survey on around 150 public (NHS) and private hospitals in the UK (see Bloom et al. 2008) and found that: (i) there seems to be substantial variation in management practices across hospitals; (ii) this was positively correlated with patient’s health outcome measures; and (iii) differences in ownership forms (public, foundation trusts and private) were strongly correlated with management practices. In a smaller pilot survey on management practices in 17 UK Schools in 2006 we discovered the survey mechanism also seemed to pick-up differences in management practices across schools (Besley et al. 2007).

This career proposal would allow me to plan and run a Summer of 2010 survey of several thousand schools and hospitals across the US, Asia and Europe. This would of course require additional external funding, which the Centre for Economic Performance (CEP) at the LSE would provide. London is also an attractive location for an international telephone surveys because of the convenient time-zone for Asia, Europe and the US, and the ready supply of students with European and Asian languages. Along with John Van Reenen, I am also in discussions with the OECD over using their PISA schools and hospitals databases as baseline sampling frames and performance databases for schools and hospitals across countries. This would be supplemented by additional national databases, such as the American Hospitals Association and Schools Common Core data in the US.

This new international management practices database for schools and hospitals would help to address a number of important policy issues. For example, the relationship between the organization and regulation of these public services and their management practices, the role of competition in improving public sector management, the importance of skills supply and practitioners (i.e. doctors)
managing hospitals versus (non-practitioner) professional managers. Also, by overlapping the country sample with those covered by the manufacturing management survey I will be able to investigate to what extent management practice traits are common for individual countries. For example, in the manufacturing survey the Anglo-Saxon countries were significantly stronger on human-capital management (pay, promotions and retention) while the Germans, Japanese and Swedish were stronger on operations management. If these differences also manifested themselves in the management of public sector organizations it would have important implications for national comparative advantage.

4. Trade and technology

A vigorous political debate is in progress over the impact of globalization on the economies of the developed world (e.g. Krugman, 2007). The growth of China looms large in these discussions, as the GDP of China has experienced tremendous growth over the last two decades, averaging some 9-10% per year in real terms.\textsuperscript{9} In terms of GDP at current exchange rates, China now ranks as the world’s fourth largest economy. This even underestimates China’s influence since much of the economy is in the non-market sector so in PPP terms China may be second only to the United States.

The rise of China and other emerging economies such as India, Mexico and Brazil has coincided with an increase in wage inequality in the United States and other developed nations. Many writers have drawn a link between the two trends, not least because basic trade theory would predict that the integration of an economy abundant in less skilled labor with a developed economy abundant in skilled labor would lead to an increase in the relative price of skill in the developed economy.

Despite this the consensus amongst empirical economists is that trade has not been a major cause of increased wage inequality in advanced countries and that technological and institutional change are more important.\textsuperscript{10} Recent theoretical work, however, shows how trade could potentially induce technical change (e.g. Acemoglu 1999 and 2002). Furthermore, much of the consensus on trade was reached using data pre-dating the rise of China in the 1990s, and there is evidence from developing countries of a link between trade and inequality (e.g. Goldberg and Pavcnik, 2006).

Understanding the role of trade in driving technology, productivity and inequality is clearly a central issue for policymakers when thinking about how to deal with rising import competition from developing countries. In this career proposal I want to use two new international micro-data sets to examine the impact of the growth of Chinese imports on US and European firms over the last decade. I will first describe the new datasets, and then some preliminary results from these

4.1. International IT and innovation data

I have been building up a major new establishment level IT database with Mirko Draca and John Van Reenen. This has been purchased from a survey firm called Harte-Hanks International (HHI), and contains panel IT data on around 160,000 establishments in Europe and 200,000 in the US going back to the late 1990s.\textsuperscript{11} HHI surveys these establishments on a rolling basis, with a median of 11 months between resurveys. The data covers the use of PCs, servers, software, networks and other hardware, with HHI aiming to survey all firms with 100 or more employees (so the sample contains many establishments with less than 100 employees). The data is sold to firms like Dell, IBM and Microsoft for marketing purposes, which should improve accuracy since errors will be noticed by them when they use it to place marketing calls. This data is also comparable internationally because

\textsuperscript{9}Of course other developing countries increased their exports to the US and Europe over this period, but as Bernard et al. (2004) point out China accounts for over 80% of the total growth.

\textsuperscript{10}See, for example, Card and DiNardo 2005 and Autor, Katz and Kearney 2008.

\textsuperscript{11}Subsets of this data have been used before by other researchers - for example, Bresnahan et al. (2002) and Brynjolfsson and Hitt (2002) used the 1987-1995 establishments of publicly quoted firms, while Beaudary et al. (2006) use the 1990-2002 US establishment dataset.
HHI collects the same data from two call centres (Dublin for Europe and Gary for the US), and this is exchange rate free - e.g. the number of computers per workers.

Along with Sharon Belenzon we have also been building an international patents database using the European Patent Office (EPO) database matched to the European Amadeus and US Dunn & Bradstreet (D&B) databases. The EPO contains patenting data on around 30 million patents from 1978 to 2007. It can be easily matched into the Amadeus database covering around 14 million firms and subsidiaries in Europe, and the D&B equivalent covering around 6 million firms and sites in the US. In Europe the Amadeus data also provides basic accounting items on firms such as capital, employment, sales and wages.

Finally, these two databases are matched to the US Comtrade database, which contains 6-digit product level information on all bilateral imports and exports of countries from 1962 onwards. Using the Feenstra et al. (2005) concordance this can be matched into 4-digit product level. I will use a variety of different ways to measure the changes in Chinese trade competition over time, including changes in absolute levels of all imports, changes in the share of Chinese imports in all imports, and changes in the average price of imports.

4.2. A first cut on the impact of Chinese imports on IT and innovation

Combining these major new databases will allow me in the career proposal to investigate the links between Chinese imports and technology. The proposal will start by considering three basic groups of estimating equations, and then discuss ways to address the potential endogeneity of Chinese imports.

First, the technology intensity equations

\[
\Delta \ln \left( \frac{IT}{N} \right)_{ijkt} = \alpha^T \Delta IMPS_{jkt} + \beta^T \Delta X_{ijkt} + \epsilon_{ijkt} \tag{4.1}
\]

\[
\exp(PAT_{ijkt}) = \alpha^P IMPS_{jkt} + \beta^P X_{ijkt} + \nu_{ijkt} \tag{4.2}
\]

where in the top equation we have the change in the log of IT capital per employee, \(\ln(\frac{IT}{N})_{ijkt}\), and in the bottom equation the exponential of the patent count. These are regressed against the share of Chinese imports in all imports (IMPS_{jkt}) and a series of control variables \(X_{ijkt}\) like sales, skills and capital intensity.

Initial results suggest that increases in Chinese imports are associated with significant increases in both IT and patenting intensity of establishments. For example, Figure 5 shows this result for IT (in solid fill). Going from the lowest quintile of increase in Chinese imports by country-industry cell over 2001-2006 to the highest quintile of increase is associated with a 44% higher increase in computers per worker. Establishments in the lowest quintile increased their computers per employee by 16% compared to establishments in the top quintile which increased this by 23%. This suggests establishments are responding to the increased threat of Chinese imports by using more computers and raising their levels of patenting.

Plotted alongside the change in IT intensity is the change in employment (in checked shading) which shows that country-industry cells with a faster growth rate of Chinese imports also experienced much faster within establishment employment falls.

These employment results link to the second set of estimating equations, which are for employment

\[
\Delta \ln(N_{ijkt}) = \alpha^N \Delta IMPS_{jkt} + \beta^N X_{ijkt} + \epsilon_{ijkt} \tag{4.3}
\]

\[
\Delta \ln(N_{ijkt}) = \alpha^N \Delta IMPS_{jkt} + \beta^N X_{ijkt} + \lambda \ln \left( \frac{IT}{N} \right)_{ijkt} + \gamma \Delta IMPS_{jkt} \ln \left( \frac{IT}{N} \right)_{ijkt} + \epsilon_{ijkt}
\]

The first equation regresses the growth rate of employment against the growth of Chinese imports share (\(\Delta IMPS_{jkt}\)) and a set of controls \(X_{ijkt}\). A negative coefficient on the import share \((\alpha^N < 0)\) indicates that more Chinese imports are associated with falls in employment, consistent with Figure 5. The second equation adds in the log of PCs per employee in the plant, and log PC per employee
**Figure 5: % Growth of IT intensity and employment by Chinese import growth quintile**

Quintiles classified by 5-year difference in Chinese imports by country industry. From the left 1 (lowest exposure growth) to 5 (highest exposure growth). Vertical axis measures 5-year change in log (PCs per worker) and log (Employment).

**Figures 6: Change in employment by initial PC intensity, by low and high China exposure growth**

"Low Exposure" industries defined as lowest quintile of the 5-year difference in Chinese import fraction. "High exposure" industries those in highest quintile. Horizontal axis classifies observations according to initial level of PC intensity, going from lowest (1) to highest (5).
interacted with change of growth of Chinese imports share. A positive coefficient on IT intensity ($\lambda$) would indicate that this raises employment growth, while a positive coefficient on the interaction term ($\gamma$) would imply that higher tech establishments are less affected by rising Chinese imports.

Initial results suggest that increases in Chinese imports are associated with falls in employment, particularly for low-tech establishments. For example, Figure 6 plots in the left panel establishments in country-industry cells which are in the lowest quintile of change of Chinese imports. This is broken down by the quintiles of IT intensity. As can be seen establishments in the lowest IT intensity quintile (far left) are shrinking the fastest, while those in the highest quintile are in fact growing, consistent IT intensive firms growing relatively faster ($\lambda > 0$). On the right panel we plot the same IT quintiles for establishments in country-industry cells in the higher quintile of change in Chinese imports. What is notable is that here the lowest IT quintiles are losing employment faster than in the left panel. Hence, low tech establishments are notably more sensitive to rising levels of Chinese import growth ($\gamma < 0$).

Finally, we can also estimate establishment survival equations. These are similar to those for employment growth rates, but instead with the dependent variable being 1 if the establishment if alive in 2001 and also 2006, and 0 if it is alive in 2001 and dead by 2006. Again, in this case the preliminary results are that rising Chinese import shares are significantly associated with lower levels of establishment survival, and this is particularly true for low IT intensive firms.

So in summary rising Chinese imports appear to be associated with within, between and exit effects increasing technology use. This career proposal will develop this work in much more detail, including looking at different measures of technology (PC types, software and networks), looking at productivity, the impact of China via intermediate inputs and cite weighting patents to control for defensive patenting.

4.3. Endogeneity

An obvious problem with estimating these equations is endogeneity of Chinese imports. To address this I want to try a variety of different approaches.

The first argues that the overall increase in Chinese exports is driven fundamentally by the opening up to the global economy because of ongoing liberalization by Chinese policy makers, so is exogenous. This overall increase will have a differential effect by industry depending on whether the industry is one in which China has a comparative advantage. Industries in which China was already exporting strongly in 1999 are likely to be those that China has a comparative advantage in – such as textiles, furniture and toys – and so would experience much more rapid increase in import penetration in the subsequent 5 years. Consequently, high exposure to Chinese imports in 1999 can be used (interacted with overall Chinese trade growth in the world, ) as a potential instrument for subsequent Chinese import growth. In other words we use ($\text{IMPS}_{j99} \times \Delta M^{\text{China}}$) as an instrument the Chinese import share in industry $j$ in the world (not specific to country $k$). Preliminary results on this show that the technology, patenting, employment and survival results are robust (typically with larger point estimates) to this instrumentation strategy.

A second identification strategy is to use the accession of China to the WTO that generated a fall in tariff barriers in many OECD economies. This disproportionately affected some industries (such as textiles) generating a large surge in Chinese imports in these industries. A third identification strategy is to use the differential cost of transporting Chinese imports to regions across Europe and the US. This can be estimated from the cost of a container shipping from China to the main destinations in our dataset. Those areas to which it is cheaper to ship Chinese goods to (for example the West Coast of the US) should have experienced a greater increase in Chinese imports than those to which it is expensive to ship to (for example, Finland or Switzerland).
5. Broader Educational, Policy and Research Impact

This proposal will also integrate an important educational component. One route for this is through supervising and coauthoring with PhD students. This is an important way to teach PhD students empirical research skills which they can not learn in the class-room. I also enjoy working with students and find coauthorship a productive way to get them engaged in large and complex empirical projects. I am currently coauthoring with 9 PhD students from Stanford, Berkeley and LSE, and supervising 2 more (listed on my CV). In recognition of this, I won the inaugural Stanford Graduate Economics Association PhD supervising award in 2008, voted on by 75 of the Stanford PhD students. On all three elements of this career proposal, I have already involved PhD student coauthors in the initial work, so they and future PhD coauthors will directly benefit from this. As a PhD student at UCL I benefitted tremendously from coauthoring with faculty and I want to pass on these benefits to my students.

The other educational route is through teaching, in which I incorporate research output. I have included some of the management and uncertainty work in my undergraduate topics class, and my 2nd year PhD Macro and Labor classes. The aim in all three classes is to get students engaged in research through undertaking their own research papers, both during the class-room and with follow-up meetings outside class. For example, I am currently working on a project using firm level implied volatility data with three students from my second-year macro class (Matthew Elliot, Luke Stein and Elizabeth Stone) which directly came from a class covering some of my recent uncertainty work. More broadly I have also been engaged in teaching a broader business and policy audience. For example, I ran four 1-day “The Economics of Productivity” training courses for UK Treasury officials, have set up a “Management and Organization” 1-week mini-course for MBAs at Stanford GSB, and appeared as a guest lecturer on management practices in Stanford GSB and Stanford Law School courses. All of these are voluntary, and I do them in large part as I enjoy interacting with students and see this as an effective route to disseminate research.

On the policy front I have also presented this research at a number of policy events - for example at Standard Institute of Economic Policy Research meetings for Bay Area business people, at joint LSE-McKinsey-Stanford breakfast meetings for business people in New York and London, and at the World Bank, IMF, UK Treasury, Bank of England, Bundesbank, Banc de France, the Board of Governors and the San Francisco, Boston, Kansas, Cleveland, Richmond and Chicago regional Federal Reserve Boards. Furthermore, the fact that we obtained over 20 endorsement letters from Central Banks, Governments and Employers Federations around the world for the management research shows the importance decision makers place on research into improving productivity.

In terms of broader dissemination I have also written up my work in 11 policy focused research summaries published by SIEPR, Centrepiece and VOX. This has led to substantial business media coverage of this work, including over a dozen pieces in the New York Times, Washington Post, Economist, Newsweek and Businessweek.

Finally, I have been developing the management research infrastructure for the broader academic community. This has involved hosting all the survey planning, hiring, training and soliciting documentation on a management section on my web-site.12 This includes all the material I developed during the last two survey waves, a video of the 2006 survey, and anonymized data from the 2004 survey wave. Because of this I have been contacted by - and am now helping - researchers in the US, Canada, Australia, Ireland and Brazil run their own management surveys. I am also working with the EBRD and World Bank in developing a Management, Innovation and Organization model for the BEEPS survey for firms in developing countries, which is being rolled out to Eastern Europe in September 2008. I was also part of the Conference Board & NSF July 22nd data workshop, involving disseminating the procedures behind the double-blind management survey.

12http://www.stanford.edu/~nbloom/index_files/Page371.htm
1. References:


