Report on the CEPR/ Centro Studi Luca d'Agliano/ CESPRI workshop on "International Trade and Wage Inequality: Theory and Measurement" at Università Bocconi in Milan from 22/23 October 1999.

The organizers were Riccardo Faini of Università degli Studi di Brescia, International Monetary Fund, and CEPR, Giorgio Barba Navaretti of Università di Ancona and Centro Studi Luca d'Agliano, André Sapir of ECARES, Université Libre de Bruxelles, European Commission, and CEPR, and Alessandro Turrini of CESPRI, Università Bocconi, Milan, Università di Bergamo, and CEPR.

Chair of the first session is Riccardo Faini.
Michael C. Burda* of Humboldt Universität zu Berlin and Barbara Dluhosch of Universität zu Köln present the paper "Globalization and Labor Markets". The authors develop a general equilibrium model of horizontal and vertical product differentiation in a North-North world. A large number of stylised facts is accounted for and/ or explained: bimodal growth of high skilled and low skilled services, fragmentation of production processes as concomitant phenomenon of globalization; the decline in relative demand for unskilled workers; and the negative relationship between unemployment and inequality. They extend the Krugman-Dixit-Stiglitz framework in several respects: There are three sectors (differentiated final manufacturing goods, consumer services, and business services); and two factors (high- and low skilled labour); manufacturing firms determine endogenously the fragmentation depth of the production process thereby competing not only by their choice of prices, but also by their choice of production technology; firms face the trade-off of a smaller marginal cost as fragmentation increases, while at the same time fixed cost in terms of high skilled business services (management) rise. As management methods become more efficient and world market size grows, firms choose to outsource more and more production steps yielding finer vertical differentiation. 2 comparative-static experiments are undertaken: First, what happens, if productivity of business services rises, e.g. because communication cost have fallen? Then, production depth rises and the demand for high skilled business services raises, raising wages for high skilled relative to low skilled labour or, if wages are assumed sticky (the European case) inducing unemployment. Second, what happens if the size of the economy (in terms of endowments) raises? This yields both an increased horizontal and vertical differentiation, an accelerated de-industrialisation and wage inequality/ unemployment as long as the fraction of skilled workers in services exceeds that of unskilled workers.

Riccardo Faini of Università degli Studi di Brescia, IMF, and CEPR remarks that the assumptions on high-skilled/ low-skilled labour substitutability/ complementarity are crucial for the results obtained and wonders whether empirical studies exist that support these assumptions. Sebastian Jean of CEPII, Paris, objects that the increase of skilled labour demand observed within the manufacturing sector is not captured in the theoretical model. Michael Burda replies that this is due to a measurement problem, since business services are not always outsourced. Jean-François Ruhashyankiko of London School of Economics remarks that the model is applicable to North-South trade, if low-skill labour endowments are increased in a comparative static exercise.

Gilles Duranton of London School of Economics and CEPR presents the paper "Globalization, Productive Systems, and Inequalities". For the labour market malaise, i.e. wage inequality in the US and the unemployment problem in Europe, two potential culprits have been discussed in the literature: skill-biased technological change and international trade.

The author argues that the two culprits may in fact present two sides of the same coin. The example of the Spanish car-part supply industry is given. After EU entry a two tier technology market structure emerged with a traditional technology used by some firms and a modern one (e.g. just-in-time production) by others. The 2-country model allows for two types of workers: skilled and unskilled. The endowments and the level of skill are exogenous. There are competitive upstream firms assembling a final good from intermediate goods using a functional form as of Dixit-Stiglitz-Krugman. The assembling technology is chosen endogenously by trading-off the higher total factor productivity of the modern technology with a smaller factor productivity caused by a smaller number of intermediate goods suppliers, since only those intermediate goods suppliers that use at least the same skill level as labour input can supply to this final goods firm. Foreign intermediate goods suppliers are required to have an even higher skill level than the domestic final goods producer (i.e. additional communication skills). The process of globalisation is described as follows: the endowment of skilled workers increases and the requirements of additional communication skills falls continuously. First a core-periphery pattern emerges with foreign modern intermediate goods firms delivering to domestic final goods firms and old technology firms delivering to foreign old technology final goods producers. As a consequence, the home country is richer and has equal wages among skilled and unskilled, whereas the foreign has wage inequality and is poorer and becomes marginalized in the world trading system. Second, as globalisation continues, the modern intermediate goods firms of both countries begin to produce for a modern final goods sector in both countries, whereas old technology suppliers produce for old technology final goods firms. As a result, there is wage inequality among skilled and unskilled also in the rich home country.

André Sapir of ECARES, Université Libre de Bruxelles, and CEPR remarks that the culprit would still be technology and not trade, if one regards the modern technology as a new good. Then trade would not play a role in this model and the inequality results would emerge likewise. Gianmarco Ottaviano of Università di Bologna, Università Bocconi, and CEPR asks for a welfare analysis of this model. Jonathan Haskel of Queen Mary and Westfield College, London, and CEPR wonders, whether it was possible to introduce a cost of changing technology. The author suspects that this would not change the results of the paper as long as a simple form of these costs is implemented.

The chair of the second session is Michael Burda.

Philippe Monfort* of Université Catholique de Louvain and Gianmarco I P Ottaviano of Università di Bologna, Università Bocconi, Milan, and CEPR present the paper “Local Labor Markets, Skill Accumulation and Regional Disparities”. The interrelation between location choice of manufacturing firms and skill choice by workers is explored in the light of trade liberalisation. Competition acts as centrifugal force and the pool of skilled workers acts as centripedal force. There are a modern (manufacturing) and a traditional good in the economy. Every worker has two units of time and decides whether to work as unskilled worker or to spend one unit upgrading skills and work one period as high skilled worker. The labour market for low skilled workers matches instantly, whereas there may be skilled workers not finding a job even though there are vacancies open (imperfect matching). Those skilled workers who do not find a job as skilled worker become employed as unskilled worker. There are additionally costs of training and search costs for firms. The traditional sector uses low-skilled labour only, whereas the modern sector uses high skilled labour only. High skilled wages are set by decentralised Nash-bargaining. There is Cournot competition in the modern sector, price discrimination of home and foreign consumers, and iceberg transport cost for delivering abroad in the modern sector, but not in the traditional one. Depending on the assumption on the matching technology (decreasing or increasing returns) the authors find in the case of decreasing returns that the larger share of the modern sector is sustained in the region which either has a better access to world markets or a better functioning labour market. In the

case of an increasing returns matching function a more complex picture emerges: If transport cost are high, then the same applies as before. If transport cost are low, then the entire modern sector will concentrate in the region which has a tiny small advantage in terms of market access or labour market functioning (low-skill-bad-jobs trap).
Michael Burda asked, what happened in the razor-edge case of a constant returns matching function. The authors replied that then a continuum of equilibria emerges. Jonathan Haskel wondered, whether firms could possibly internalise the externality of the training decision of workers on the firm's probability of finding a suitable worker by allowing firms to bear (part of) the training cost of workers.

David Greenaway of University of Nottingham, Michelle Haynes of University of Nottingham, Richard Upward* of University of Nottingham, and Peter Wright of University of Nottingham and CEPR present the paper "Estimating the Wage Costs of Inter- and Intra-sectoral Adjustment". The authors explore empirically to which extend wages increase with tenure. This allows to estimate the costs of workers to change jobs, industry, and occupation. The theory tested agues that a worker who is forced to move job may loose her specific human capital and this loss may be the larger the more different the new job is (i.e. in a different industry or a different occupation). Hence, there may be a wage premium to tenure and this premium measures the adjustment cost of workers changing industry. On the contrary, workers may also quit a job, because a better match allows to earn higher wages. Moreover, more able workers may quit job less often. The UK New Earnings Survey Panel Dataset is used for the period from 1975-1998 capturing about 1% of civilian employees in Britain. The data set records tenure precisely, but does not provide information on education. Pooled OLS estimates, fixed effect GLS estimates, and random effects GLS estimates are done for explaining wages in dependence of total labour market experience, firm tenure, industry tenure, and occupational tenure controlling for a number of other variables that explain wages and taking care of cohort effects. The control variables include: age, sector, occupation, industry, and region dummies. The nature of the error terms and unobserved independent variable bias are discussed. The finding confirms the existence of a significant, but small wage premium for industry specific tenure on top of occupational and job tenure. This tenure is the larger the older is the worker (i.e. older workers have larger adjustment cost). The industry tenure wage premium is larger than the occupational tenure wage premium.
Tryphon Kollintzas of Athens University of Economics and Business and CEPR notes that those workers quitting the job voluntarily, because they get better wages somewhere else, can be sorted out of the sample leaving those cases when workers become displaced. Seperate regressions can be run for those sub-samples. Rudolfo Helg of Libero Istituto Universitario Carlo Cattaneo suggests to allow for heterogeneous slope coefficients in the estimation technique. Jonathan Haskel suggests that the scale of fraud with national insurance numbers may be quite large contaminating the data. Matthew Slaughter of Dartmouth College and NBER adds that non-wage compensations are quite large in the US and may also be important for the UK. He also points out that usual estimates of the gains of inter-industry trade are usually quite small and would have to be confronted with the cost of adjustment estimated in this paper.
The chair of the third session is André Sapir.
Olga Cantó of Fundación Universitaria San Pablo CEU-Elche, Ana Rute Cardoso of Universidade do Minho, and Juan Francisco Jimeno* of Universidad de Alcalá, FEDEA, Madrid and CEPR present a paper on "Integration and Income Distribution: Lessons from the Accession of Portugal and Spain to the EU". The authors explore the impact of the entry of Spain and Portugal into the EU in 1986 on wage and income inequality both on national and on regional levels. They regard the implications of international trade flows and specialisation patterns, and the importance of labour market and government institutions (social welfare system) for the different trends in the two countries. Whereas Portugal

experienced a widening of both income inequality and wage inequality, but no rise in geographical inequality, while unemployment remains low, Spain is characterised by a stable income inequality, a larger wage inequality, a larger unemployment rate, and larger regional inequalities. The difference in wage and income inequality of Spain is attributed to the establishment of a welfare state similar to the rest of Europe. The increase in wage inequality is explained for Portugal by an increase in the return to schooling. There is a negative wage premium for blue collar production workers and for textile workers, indicating that low wages are the basis for the international competitiveness of Portugal. In Spain wage inequality is explained by returns to tenure, a lower gap between wages of production workers, a lower variation of wages across industries, and regional dummies. This indicates that labour market institutions (collective bargaining) may play an important role in explaining wage inequalities. By exploring the employment share of workers with university degree, the authors conclude that industry bias of technological progress may be the main force behind the increasing demand for high-skilled workers. Export sectors, however, remain specialised in low-skill production both for Spain and Portugal. Finally, FDI is found to have a positive impact on regional labour productivity besides its capital accumulation effect, whereas the impact of EU transfers on regional labour productivity has been relatively small.

André Sapir suggests to differentiate Intra-European trade from Extra-European Trade. The authors reply that intra-European trade accounts for about 80 % of total trade in Portugal and even more in Spain. Giorgio Barba Navaretti of Università di Ancona and Centro Studi Luca d'Agliano remarks that the 2 categories of unskilled labour may be differently defined for Spain and Portugal. Giorgio Basevi of Università di Bologna points out that real exchange rate changes may be important to explain some results and wonders, whether legal and illegal migration flows were important to explain wage inequality. The authors reply that there was little migration in the two countries. Tryphon Kollintzas of Athens University of Economics and Business and CEPR recommends to employ information on capital income in the analysis.

Jonathan Haskel* of Queen Mary and Westfield College, London, and CEPR, and Matthew Slaughter of Dartmouth College and NBER present the paper "Trade, Technology, and UK Wage Inequality". The authors explain UK wage inequality by their culprits international trade and skill- biased total factor productivity taking into account the Rybczinsky-effect that larger demand for skilled workers may be accommodated by changes in inter-sectoral specialisation patterns rather than relative wage changes of skilled- and unskilled-labour. They propose two empirical methods based on the zero profit conditions of multi-sector, multi-factor HO-models: First, they assume total factor productivity and sectoral value added prices to be exogenous for the UK and explain them by the cost shares of the production factors skilled labour, unskilled labour and capital (mandated wage regression). The estimation coefficients are the mandated factor prices. Second, they assume prices and productivity to be endogenous and implement a two stage procedure: in the first stage, they regress decade changes of sectoral total factor productivity and sectoral value added prices on a set of explanatory variables; in the second stage, they explain the contributions of these explanatory variables by the cost shares of the three production factors. Again, the estimation coefficients of the second stage yield mandatory wages. The estimates are confronted with one-sector estimates of relative wages as in previous studies. Those procedures are done separately for the 60ies, 70ies, and 80ies. According to the first method, the sector bias in price changes mandated a significant rise in inequality of skilled relative to unskilled wages, whereas total factor productivity mandated an insignificant decline in wage inequality of the UK during the 80ies. The mandated wage changes are found to be reasonably close to actual skilled wage changes, but unskilled wage changes are under-predicted consistently. The later may be due to the changes in relative labour supply. As for the two stage procedure the

results are as follows: Innovations significantly increase inequality (which must be counterbalanced by other determinants of total factor productivity to be in line with the results of the first method). So did the fall in the degree of unionisation. There is mixed support for the hypothesis that trade-induced total factor productivity growth has raised inequality. The findings rather indicate that increased international competition has increased total factor productivity, but not induced a sector bias. Import price changes resulted in an insignificant rise in inequality indicating that sectoral value added price changes are only weakly linked to international trade.
André Sapir remarks that the first stage estimation assumes imperfect competition, whereas the second stage assumes perfect competition. The authors reply that the second stage would be consistent with imperfect competition as long as monopoly mark-ups are assumed constant. Tryphon Kollintzas adds that a constant returns to scale technology is assumed in the second stage estimation. Allowing for non-constant returns may be more in line with the first stage. He also remarks that the complementarity relation between equipment and high skilled labour should be accounted for. The authors reply that they have no data to do this.

The chair of the fourth session is Tryphon Kollintzas of Athens University of Economics and Business and CEPR.
Sébastien Jean* of CEPII, Paris, and Olivier Bontout of DREES, Paris, present the paper "What Drove Relative Wages in France? Structural Decomposition Analysis in A General Equilibrium Framework, 1970-1992". The authors explain the relative change of skilled/ unskilled wages in France from 1972 to 1992 in a computable general equilibrium (CGE) model by decomposing the wage change induced by 4 culprits: technology bias, factor supply changes, changes in consumption structure, and international trade. Thus the paper avoids looking at the 4 culprits in isolation and takes the general equilibrium interaction of those 4 culprits into account. The CGE model employs an Armington condition, but allows also for horizontal product differentiation, increasing returns to scale, monopolistic competition, Cournot-competition, and trade-induced effects on productivity. The model allows for 1 service sector and 8 industrial and agricultural sectors, as well as 4 production factors: high- and low-skilled labour, capital and intermediate goods. Import goods from the South and the North are distinguished. To deal with the French unemployment problem mainly among unskilled workers in a context of general equilibrium, the wages are adjusted as if there was full employment. The model is calibrated for French data of the years 1970 and 1992. The authors find that technological change contributed strongly towards a rise of relative wages for skilled labour, whereas the increased relative factor supply of skilled labour counterbalances the first effect leaving the relative wages roughly unchanged. Also the shift of consumption patterns towards services increased slightly the wage inequality, whereas international trade contributed only weakly to wage inequality mainly via trade-induced skill biased productivity increases.
Matthew Slaughter comments that it may be useful to differentiate among different service sectors, since factor intensities vary substantially across different service industries. The authors reply that they lack consumption data to incorporate this feature. Matthew Slaughter also remarks that the Armington-condition of the CGE-model may allow factor supply changes to have a major impact on relative wages, whereas changes in sectoral specialisation patterns would occur in a HO-model. Alessandro Turrini of CESPRI, Università Bocconi, Milan, Università di Bergamo, and CEPR suggests to calibrate the entire time path annually from 1970 until 1992 rather than to focus on those two years only.

The chair of the sixth session is Enzo Grilli of The World Bank.
Giovanni Bruno of Università Bocconi, Milan, and Anna Falzoni* of Università di Bergamo present the paper: "Multinational Corporations, Wages, and Employment: Do Adjustment Cost Matter?". The paper estimates in a panel

data analysis, whether US Multinational Firms have replaced labour in the US with labour in some host country or instead new jobs abroad have also generated new jobs in the US. The authors deviate from previous work by allowing for adjustment cost and a dynamic adjustment process of a plant's labour demand after some factor price shock. Adjustment costs may result, for example, from costs of setting up or shutting down production plants abroad. The authors show in an example that short run labour demand elasticities may be misleading, if estimated in a static econometric framework. They derive the dynamic labour demand from a dynamic duality approach and test this theoretical framework by applying a General Method of Moment Estimator to an annual panel data set. An industry-level data set of the Bureau of Economic Analysis from 1982 until 1994 distinguishing employment of 32 different industries in the US and 4 regions (Canada, Latin-America, Europe and the rest of the world) is employed. The results are: 1) in some instances, short and long run labour demand elasticities are reversed which justifies the approach; 2) there are significant adjustment cost for US affiliates in Canada and Latin-America, whereas US affiliates face no significant adjustment cost in Europe.

André Sapir remarks that contrary to the results one would expect high adjustment cost in Europe and low adjustment cost in Canada due to different rigidities of European and Canadian labour markets. Lucia Tajoli of Politecnico di Milano suggests that the low adjustment cost in Europe may result from US firms expanding in Europe by Mergers and Acquisitions rather than by greenfield investments. Giorgio Basevi asks, whether it was possible to break down South America into Mexico and the residual. The authors reply that then only 6 industries could be used in the data set. Matthew Slaughter suggests to use service industries as a benchmark.

Henrik Braconier and Karolina Ekholm* of The Research Institute of Industrial Economics (IUI), Stockholm, present the paper "Multinationals and Wage Competition Between Different Locations". This paper determines the substitutability/complementarity relation of parent and affiliate labour demand across different high and low income locations. A partial equilibrium model of a multinational firm is developed with many affiliates and sales in many locations. In contrast to standard labour demand theory, wage changes do not only determine the marginal cost of an affiliate and thus its labour demand, but also the entry and exit of an affiliate and its impact on labour demand. The resulting cross wage elasticities, conditions for entry and exit of affiliates, and the testing equation are derived. A panel-data set on Swedish multinational firms at 6 points of time (from 1970 until 1994) including 44 firms and 594 affiliates is used. The data show a substantial increase of the share of affiliate employment in high wage countries and a corresponding decline of the share of parent employment in Sweden over time. Fixed effect models are estimated separately for parent employment and affiliate employment. Parent and affiliate employment depend on average wages paid by all Swedish multinationals in the sample in Sweden, in high income countries, and in low income countries. Swedish industry consumption and exports control for demand effects in parent employment regressions. Host country aggregate consumption and Swedish industry consumption control for demand effects in affiliate employment regressions. Parent employment regressions use alternatively unit labour costs and the sub-sample of parent firms with exclusively high income affiliates. Affiliate employment regressions distinguish affiliates in high and low income locations. Firm or affiliate specific fixed effects, country dummies and time dummies are included. Also, the sub-sample of low income countries is split up into European low income location affiliates and those of the rest of the world. The following results are found: Among the Swedish parent and affiliates in high income locations exists a substitutability relation; among the Swedish parents and low income locations exists a complementarity relation; across high income locations and across low income locations exists a complementarity relation.

Jonathan Haskel suggests to control for effects of technological progress. Jean-François Ruhashyankiko wonders about potential endogeneity bias problems of the estimation procedure. Matthew Slaughter suggests to use industry wage data rather than firm wage data to control for the industry change in skill-upgrading.

The chair of the last session is Rodolfo Helg of Libero Istituto Universitario Carlo Cattaneo.
Rodrigo Navia of Universidad Catolica de Valparaiso, Douglas Nelson of Tulane University, and Timothy Wedding of the US Government Accounting Office, Washington, present the paper "Treating the Stolper-Samuelson Theorem Seriously: The Long Run Relationship between Relative Commodity Prices and Relative Factor Prices". The authors attempt to test empirically the long run relationship between commodity prices and the ratio of high and low-skilled wages as explored by the Stolper-Samuelson Theorem of the Heckscher-Ohlin-Samuelson (HOS) model. This theorem says that a rise in the commodity price of a good rises the relative factor price of the factor used intensively in its production. They argue that the theorem describes a long run relationship and is thus appropriately tested in a time series analysis rather than a cross section analysis. Since higher-dimensional HOS-models do not yield clear cut theoretical predictions, the wage variables are constructed in various ways from education-specific wage indices of the US in a 2 sector, 2 factor framework; the commodity price indices are constructed by aggregation of price data distinguishing above and below average skilled- and unskilled labour intensive industries. The Johansen method of cointegration analysis is applied to those annual data from 1967 until 1987. Weak evidence is found in favour of Stolper-Samuelson effects.
Matthew Slaughter suggests to net out non-traded goods sectors and wonders how technological change is accounted for. The author replies that technological change is accounted for by a time trend variable. Michael Burda asks, whether weights of the indexes constructed were kept constant, since price changes induce quantity changes. The authors reply that they used constant middle period weights.

Neil Gandal of Tel Aviv University and CEPR, Gordon Hanson of University of Michigan and NBER, and Matthew Slaughter of Dartmouth College and NBER are presenting the paper "Rybczysnki Effects and Adjustment to Immigration in Israel". Israel experienced after the fall of the iron curtain in late 1989 and a relaxation of emigration laws of the former Soviet Union a surge of immigration of Russian Jews which increased the Israeli work force by 13%. Moreover, the Russian immigrants were relatively high skilled compared to the Israeli average and were quickly absorbed in the Israeli labour market. The authors take this incidence to test for the Rybczynski effect. The change in the composition of skills of the Israeli labour force is expected for a small open economy facing world market prices to change its product mix towards more skill intensive industries according to this theorem (without considerable changes in relative factor prices). Alternatively, the production technology may change to accommodate for the change of the skilled-/unskilled-labour composition of the labour supply and the change in the capital/labour ratio. This analysis is in contrast to a single-sector labour-market analysis of immigration. Data on Israeli value added, employment of capital and labour, wages of 4 education categories by 19 sectors for 1980-1996 are used. The changes in factor supplies are decomposed into various factor demand categories as follows from a multi-factor multi-sector form of the Rybczynki theorem. Different periods of adjustment towards the new equilibrium are allowed for. General changes in production technology due to global shocks are controlled for by using data on technology changes in sectors of the US. Also technology changes in non-traded goods sectors are taken account of. The main results are that Russian immigrants were absorbed in the Israeli labour market by Israeli firms specialising more in moderately skill-intensive sectors as predicted by the Rybczynski theorem. In contrast, a change in production technology accounted for relatively little

absorbtion of factor supply growth and is more related to world wide shocks rather than to Israeli-specific shocks of the factor supplies.

André Sapir remarks that it may be important to take age differences of the immigrants relative to the average Israeli population into account. Marion Jansen of WTO asks how global shocks are taken account of. The authors reply that US sector data are matched up with the Israeli sector data. Philippe Monfort of Université Catholique de Louvain remarks that HO-theory is tested by assuming factor price equalisation.