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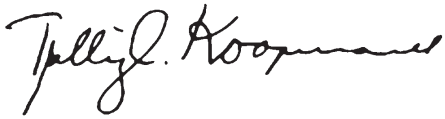

Discussion Paper Series nr: 04-29

Skills and Creativity in a Cross-section of Dutch Cities

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Stichting Atlas voor gemeenten

Utrecht School of Economics
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October 2004

Abstract
In this paper we examine Richard Florida's Creative Capital theory in comparison with Human Capital theory, using a cross section of Dutch cities as our sample. Employment growth in Dutch cities can be predicted both from local education levels and from the presence of a large creative class, but especially from the latter. We conclude that in theory creativity is not very different from human capital. Nevertheless Florida's creative class is a better standard to measure human capital then education is.

Keywords: human capital, creative class, urban growth.

Acknowledgements
Maarten Bosker, Harry Garretsen, Frank van Oort, Joost Poort, Klarita Sadiraj and Marc Schramm.

1. INTRODUCTION

In his recent best-selling book *The Rise of the Creative Class,* Richard Florida has propounded what he claims to be a new theory on regional economic growth.[1] His Creative Class is creative and innovative and, as a result of this, remarkable for its high productivity. Accordingly, cities and regions whose populations show high levels of creativity grow faster. Florida says his Creative Capital theory is significantly different from Human Capital theory.

Less recently, and less best-selling, social scientists emphasized the role of human capital in regional economic growth. Human capital results from people, especially skilled and educated people. Where skilled people concentrate, human capital accumulates. Skilled and highly educated people have an ability to generate and to absorb knowledge; this is why they are more productive. Firms are therefore more competitive if they are located in cities and regions with high levels of human capital. These places grow faster than cities and regions with low levels of human capital.[2] Where human capital concentrates it is likely to accumulate. Human capital accumulation is, according to Robert Lucas, a 'social activity'. Highly educated and skilled people interact face to face and this is how they increase both their own and each other's knowledge.[3] The need for face-to-face contact means that dense cities must be an ideal 'pool' for human capital accumulation.[4] This leads to an expectation that a given amount of human capital accumulation will yield more spillover benefits within cities than that same amount in wider geographical regions.[5]
There is empirical evidence – both from the U.S. and the U.K. – supporting the Human Capital theory.[6] Especially Edward Glaeser and his co-authors have found

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[1] R. Florida, *The Rise of the Creative Class, and how it's transforming work, leisure, community and everyday life* (New York, Basic Books 2002).
[2] See for an overview, V. K. Mathur 1999: 'Human-capital-based strategy for regional economic development', *Economic Development Quarterly* XIII (1999), 3, pp. 203–216.
[3] R. E. Lucas: 'On the mechanism of economic development', *Journal of Monetary Economics* XXII (1988), pp. 3–42.
[4] J. Jacobs, *The Economy of Cities* (Random House, New York 1969).
[5] Mathur, 'Human-capital-based strategy', p. 212.
[6] E. L. Glaeser & A. Saiz, *The Rise of the Skilled City*, NBER working paper series, 10191 (2003); C. Nardinelli & C. J. Simon, The Talk of the Town: Human capital,

convincing evidence for the nexus between human capital and economic growth: cities and regions with more educated residents grow faster than cities with smaller stocks of highly educated labor.

Human capital theory is essentially about the creation and use of knowledge by the skilled and highly educated. What can 'creativity' possibly add to that?
First of all, people in the creative class are not necessarily highly educated. According to Florida, the key to understanding regional economic growth is not a high level of education but creativity. Unfortunately Florida does not support this Creative Capital theory with much empirical analysis.
Some of the people in Florida's creative class are indeed not highly educated; but most of them are. What is the economic relevance of their creativity as compared to the relevance of their skills and education? Florida mentions their way of life, their creative ethos. Creative people like to work hard and like to talk about work when they go out in town, which they supposedly do very often.[7]
But is this anything new? Is this at all different from Jane Jacobs's view that highly educated people tend to accumulate knowledge and new ideas through face-to-face contact in dense urban areas?
It is, again, Edward Glaeser who in a recent review of Florida's book questions the novelty of Florida's concept of creativity: "If Florida wants to argue there is an effect of bohemian, creative types, over and above the effect of human capital, then presumably that should show up in the data".[8] But it doesn't, according to the growth regressions introduced by Glaeser in his review. In his analyses Glaeser has combined his human capital with Florida's creative class. The latter does not predict city growth at all.
In his response to Glaeser's critical review Florida suggests he never aimed to substitute his Creative Capital theory for the Human Capital theory. His concept of a creative class was only meant to provide an improved standard for measuring actual skills and human capital – an improvement on traditional education-based indicators.[9]

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information and the growth of English cities, 1861 to 1961, *Explorations in Economic History* XXX (1969), 3, pp. 384–413.
[7] Florida, *Rise of the Creative Class,* pp. 192–214.
[8] E. L. Glaeser, Review of Richard Florida's *The Rise of the Creative Class* (2004).
[9] R. Florida, Response to Edward Glaeser's review of *The Rise of the Creative Class* (2004), p. 2.

In this paper we examine Florida's Creative Capital theory in comparison with Human Capital theory, using a cross section of Dutch cities as our sample. As will be seen, employment growth in Dutch cities can be predicted both from local education levels and from the presence of a creative class, but especially from the latter. We agree with Glaeser that creativity is largely the same as human capital. Nevertheless, designing categories for people who are not necessarily highly educated yet highly important for economic production is useful to a better understanding of regional economic growth.
In chapter 2 we will start by explaining the way we have constructed the Dutch creative class, and describe its geography. Chapter 3 addresses the question whether or not the presence of a large creative class is affecting local economic growth, while chapter 4 explores the similarities and differences between creativity and education. Our major findings are summarized in chapter 6. In chapter 5 we report about our first attempt to find out if human capital and creativity fosters growth through higher productivity, spending or new business startups.

2. THE CREATIVE CLASS IN THE NETHERLANDS

Richards Florida's creative class is a category of people who are not necessarily highly educated but who are working in creative, innovative jobs. His creative class includes about 30% of the American labor force. The creative class not only includes writers, designers, musicians, painters and artists (who Florida calls 'bohemians'); scientists, managers and people in computer, engineering, education, healthcare, legal and financial occupations also belong to it.[10]

Inspired by Richard Florida we have devised a Dutch creative class. We used profession data (EBB) on city level from the Dutch statistical institute CBS. The data contains the professions of a sample of each city's inhabitants. It is essentially about the places where people live and their professions, not about where they work. This is

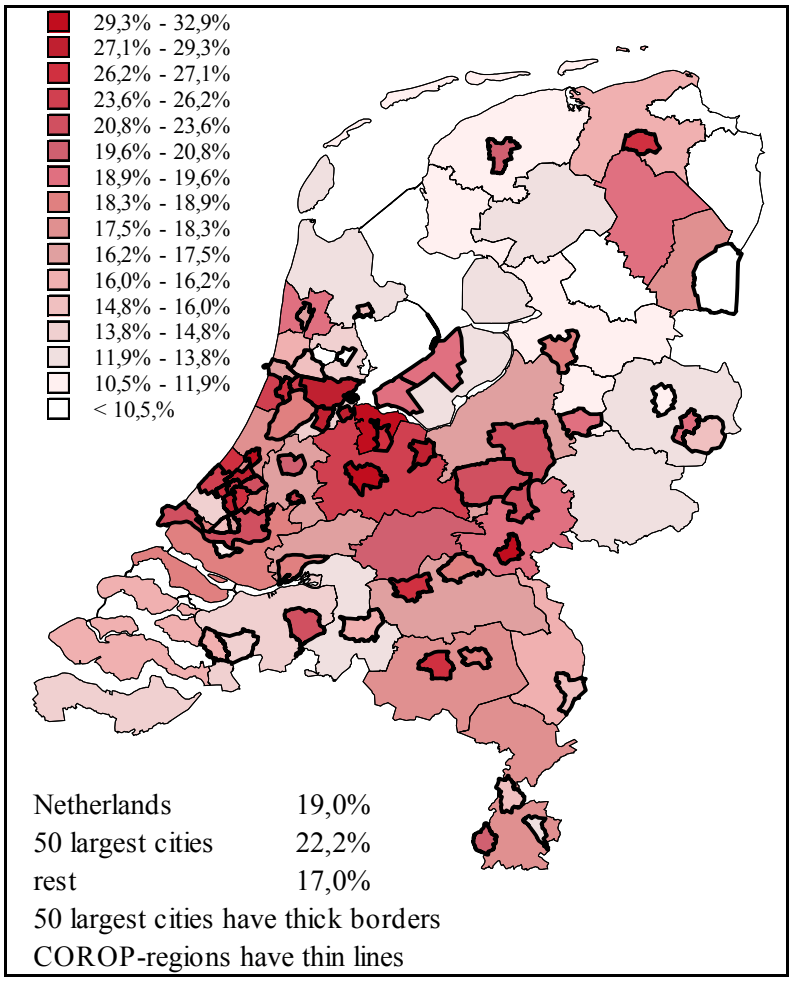
[10] Florida, *Rise of the Creative Class*, pp. 328, 329.

in line with Florida's creative capital theory stating that where creative people live the economy is growing faster – whichis to say that jobs follow people.[11]
The Dutch profession data contains 1211 different jobs. First we tried to select jobs exactly the way Florida did. We therefore tried to select from the Dutch profession data expected those jobs which we considered to be included in Florida's broad definition of the creative class: all computer and mathematical occupations, architecture and engineering, sciences, education, arts, design and entertainment, business, financial and legal occupations, healthcare, and all management and sales occupations. The creative class resulting from this includes 35% of the total Dutch labor force.
Then we tried to be more precise in selecting creative jobs. Florida included, for example, *all* people with educational and managerial jobs in the creative class. A closer look at Florida's own definition of people with creative and innovative jobs has led us to leave out several managerial, educational, administrative and governmental jobs. Thus we have excluded teachers in secondary schools from the creative class while keeping teachers in universities. This means that while the creative class according to Florida contains all 'academic level teachers and educationalists', our definition covers only 66% of the jobs in that category. While all 'academic level managers' are within Florida's creative class, only 56% of them are in the Dutch creative class. The appendix provides a more detailed picture of our job selections. Our method has yielded a Dutch creative class that contains 19% of total labor force.

Map 1 shows the geography of the Dutch creative class. Creativity concentrates in the central and western parts of the country, especially in cities. In the 50 largest cities 22.2% of total labor force belong in the creative class. In the rest of the country the creative class accounts for 17% of total labor force. These findings are quite similar to the geography of creativity in the U.S.[12]

[11] Cf. M. Boarnet, 1994: 'The monocentric model and employment location', *Journal of Urban Economics* XXXVI (1994), pp. 79–97, and: S. Kim, *The reconstruction of the American urban landscape in the twentieth century*, Working paper series, Nr. 8857 (Cambridge MA, National Bureau of Economic Research, 2002).
[12] Florida, *Rise of the Creative Class*.

Map 1 The geography of the Dutch creative class (2003)



In Utrecht – the fourth largest city in the Netherlands, right in the middle of the country – almost 33% of the labor force belongs in the creative class. In Amsterdam, the capital of Holland, creative class accounts for 27.2% of total labor force, in The Hague 23.7%, in Rotterdam 20.8%. Emmen, a rather small town in the north-east near the border with Germany, only 7.7% of the total labor force living there belongs in the creative class.[13]

[13] For a more detailed picture of the geography of creativity in The Netherlands see G. A. Marlet & C. M. C. M. van Woerkens, *Atlas voor gemeenten* [Map of municipalities] (Utrecht, Stichting Atlas voor gemeenten 2004).

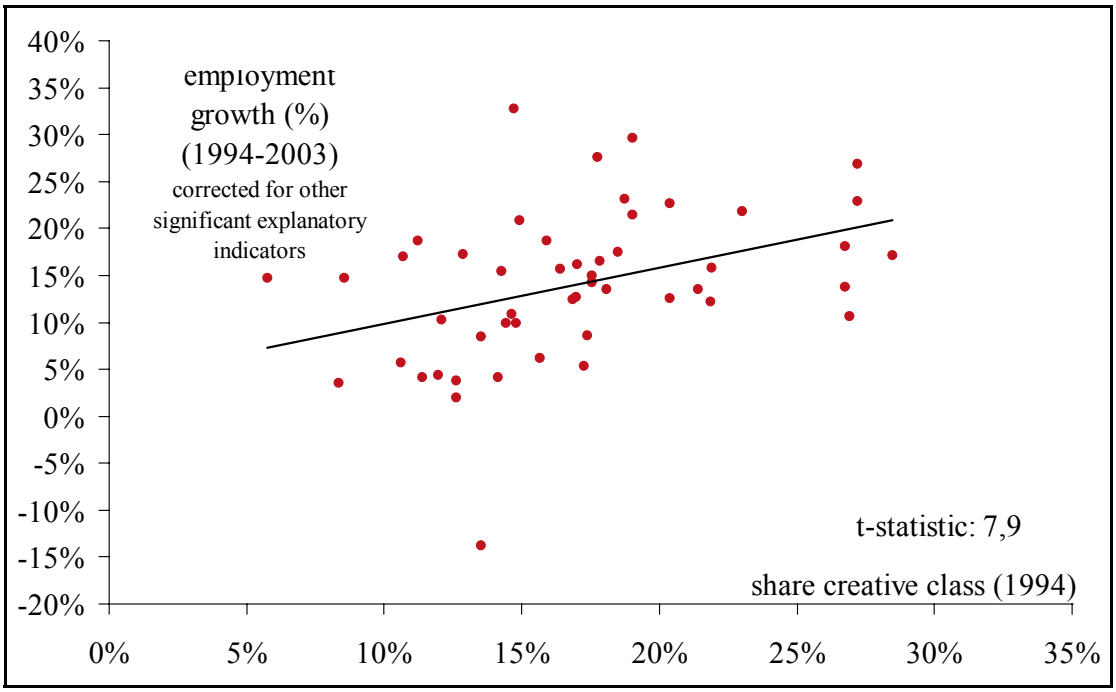
3. THE CREATIVITY-GROWTH NEXUS IN THE NETHERLANDS

In this section we will examine the relationship between creativity and growth. We are taking cities, not regions, as our unit of analysis since we are supposing that accumulation of ideas is chiefly an urban process.[14] Due to data limitations we are using for our cross-section a sample of the fifty largest Dutch cities. There is of course no rationale other than data limitations for selecting the fifty largest cities. Therefore, we used another sample of cities based on their regional function and selected by real travel-to-work patterns.[15] This selection results in thirty-one so-called Dutch core cities (see appendix for a list of cities included in the two samples).
Many skills-to-growth studies in the U.S. use population growth as an indication for city growth, suggesting population growth and employment growth are highly correlated.[16] We use employment growth instead of population growth because house building in the Netherlands is strongly regulated. Local differences in population growth between Dutch cities and regions are largely a result of centralized urban planning.

Our first model is rather simple, with employment growth as the dependent variable explained by the share of the creative class in the total labor force. With population growth heavily depending on building regulations, we are assuming that people do not follow jobs on a Dutch city level, but jobs follow people. In new cities like Almere, new grocers, bakers and butchers will emerge, creating new jobs in local services. We therefore expect population growth to be positively correlated with employment growth.
Figure 1 shows our results. We find a positive correlation between share of creative class and employment growth, corrected for population growth (highly correlated, as expected). A one-percentage-point increase in share of creative class in Dutch cities means an average increase in the employment growth rate by 0.82 percent (t-statistic: 7.90).

[14] See Jacobs, *Economy of Cities*.
[15] Based on: F. G. van Oort, *Agglomeration, Economic Growth and Innovation. Spatial analysis of growth- and R&D externalities in the Netherlands* (2002).
[16] See for example Glaeser & Saiz, *Rise of the Skilled City*.

Figure 1 Creativity and employment growth in Dutch cities



Next we enlarged our model with other variables likely to influence city growth. We tried to combine control variables representing major theories and empirical findings in both urban economics and new economic geography.

Control variables adopted from urban economics are diversity,[17] concentration,[18] and unemployment rates.[19] To indicate sectoral diversity we used the Hirschman-Herfindahl index, which is equal to the squared sum of the shares of the various sectors. Concentration is indicated by the share of industrial employment and the share of employment in financial and business services in total employment. The unemployment rate is defined as the number of unemployed people as a percentage of the total number of people that do have a job.

We then tested for agglomeration forces, both positive and negative (congestion forces).[20] Proximity to concentrations of people (market potential) is our major proxy

[17] Jacobs, *Economy of Cities.*

[18] M. Porter, *The Competitive Advantage of Nations* (1990). For an overview of diversity and concentration effects, and empirical testing for The Netherlands see Van Oort, *Agglomeration*.

[19] See Glaeser & Saiz, *Rise of the Skilled City.*

[20] P. R. Krugman, 1995: *Development, Geography and Economic Theory* (MIT Press, Cambridge Mass. 1995). For an overview of agglomeration forces and new economic geography see S. Brakman, H. Garretsen & C. van Marrewijk, *An Introduction to Geographical Economics* (Cambridge University Press 2001).

for agglomeration. The market potential in a region is equal to the weighted sum of population, the weight depending on travel time to the surrounding regions and an internal travel time for the region itself.[21]
We did calculate the relative effect of road congestion on this market potential as a proxy for all negative agglomeration effects mentioned in new economic geography literature: besides road congestion: pollution and high land prices.[22] We found strong correlations between agglomeration and congestion forces calculated in this way, which means that the relative importance of congestion is higher the more agglomerated a city or region is (correlation coefficient is 0.87). In our model estimations we found negative signs both for our congestion indicator and our agglomeration indicator. We assume this means that both highly correlated indicators work in our model as a proxy for congestion forces. This made us decide to eliminate market potential in our reduced models, and to keep congestion as a proxy for all congestion (spreading) forces of agglomeration.

The presence of a large creative class in core cities might be supposed to affect employment growth in the region. Reversely, creative people in the region might affect employment growth in the city. We test for this by introducing two spatial lag variables in the model.[23] First, a spatial lag of the creative class share in total labor force, accounting for the effect of creative people in the region. And second, a spatial lag for employment growth, indicating and accounting for all possible omitted regional variables that could influence employment growth in the city.

Table 1 shows the results of both the limited and the extended models. As expected, we find that employment growth in Dutch cities heavily depends on population growth. In most models there is a significant negative correlation between employment growth on the one hand and, on the other hand, congestion forces and high concentrations of manufacturing. This means there were spreading forces at

[21] The weight is a decreasing function with time showing an exponential decay for large travel times.
[22] See also E. Helpman, 'The size of regions', in: D. Pines, E. Sadka & I. Zilcha, *Topics in Public Economics* (Cambridge University Press 1998).
[23] A spatially lagged variable is a weighted average of that variable over the surrounding regions, the weight depending on the real travel time to those regions and the size of the regions. See L. Anselin, *Spatial Econometrics* (1988).

work in the Dutch economy of the 1990s, but not towards industrial regions. In several models there is a positive correlation between diversity (negative with lack of diversity) and employment growth. These results are largely the same as other recent empirical findings for the Netherlands.[24] According to these models, unemployment and regionally omitted variables (spatial lag of employment growth) are of no importance for employment growth.
The results are much the same for both samples of cities. To be sure, the R-squared is much lower in the sample of core cities due to a weaker correlation between population growth and employment growth: many new towns are among the fifty largest cities but do not appear in the sample of core cities. The share of manufacturing becomes less important in the core-city models, because some smaller industrial towns are not included in this sample.

For our present purpose, the most important finding is that creative class actually predicts employment growth also in the enlarged models, coefficients and significance being slightly lower compared to the limited models. Surprisingly, regional levels of creative class do not appear to influence employment growth in cities. This might lead to the conclusion that the connection between creativity and growth is a mainly urban process, knowledge spillovers being rather limited in spatial range (see above).

While we are relating creative class to employment growth, two possible confusions must be dealt with. First, the creative class may have a preference for regions with large employment growth. If so, the creative class is endogenous to the model. Second, the creative class may have preferences similar to those of firms. This could mean firms did not move to, or grow in, certain cities because of the presence of a large creative class, but because of one or more amenities or other characteristics that attract both firms and creative class.
In order to investigate these two possibilities the creative class is instrumented in several ways with variables that are exogenous to employment growth. The instrumental variable lists are a result of our empirical work on the importance of amenities for urban living patterns in The Netherlands.[25]

[24] Van Oort, *Agglomeration*.
[25] Marlet & Van Woerkens, *Atlas*.

Each third column in table 1 presents the results of our estimation with a broad set of instrumental variables: the amount of theatre and music performances, proximity to nature, number of students, share of privately owned houses, number of pubs and museums, quality of restaurants and secondary schools, share of historic buildings, crime and ethnical diversity.

Some of these amenities still might result from, rather than be causes of, the presence of a large creative class. Therefore we have made estimations with a second set of instrumental variables (each fourth column in table 1), leaving out those amenities that might not be fully exogenous: theater performances, quality of restaurants, number of pubs, and crime.

The results of both two-stage estimations are similar to the OLS and WLS estimations, although slightly less significant (see table 1). This supports our conclusion that employment growth is in fact encouraged by the presence of a large creative class.

Table 1 Creativity (1994) and employment growth (1994-2003) in Dutch cities

	Core cities				Fifty largest cities			
	limited (WLS)	extended (WLS)	instrumented (2SLS)		limited (WLS)	extended (WLS)	instrumented (2SLS)	
Creative class NL	0,85 (7,26)***	0,88 (5,30)***	1,26 (3,00)***	1,17 (2,14)**	0,82 (7,87)***	0,69 (4,96)***	1,10 (3,12)***	1,02 (2,32)**
Population growth	1,37 (7,18)***	1,17 (6,67)***	1,31 (4,90)***	1,29 (4,50)***	1,54 (23,1)***	1,43 (29,3)***	1,46 (22,9)***	1,42 (24,7)***
Spatial lag creative class		-0,56 (0,60)	0,34 (0,25)	1,07 (0,83)		0,37 (0,47)	0,56 (0,55)	1,00 (1,05)
Congestion		-0,06 (-0,99)	-0,14 (-2,26)**	-0,18 (-2,76)***		-0,10 (-2,16)**	-0,14 (-2,90)***	-0,17 (-3,21)***
Diversity		-0,42 (-1,54)*	-0,66 (-2,24)**	-0,41 (-1,37)		-0,35 (-1,53)*	-0,52 (-2,05)**	-0,35 (-1,48)
Share manufacturing		-0,27 (-1,56)	-0,26 (-1,29)	-0,39 (-1,86)*		-0,40 (-3,31)***	-0,35 (-2,40)**	-0,46 (-3,33)***
Unemployment		-0,90 (-1,88)*	-0,93 (-1,36)	-0,68 (-0,89)		-0,38 (-0,97)	-0,57 (-1,03)	-0,44 (-0,74)
Spatial lag employment growth		-0,20 (-0,45)	-0,36 (-0,63)	-0,10 (-0,16)		-0,33 (-0,91)	-0,38 (-1,18)	-0,18 (-0,46)
N	31	31	31	31	50	50	50	50
R^2 adj.	28,9%	44,0%	23,3%	27,2%	80,1%	83,8%	82,5%	83,6%

We have so far been considering our specifically Dutch definition of the creative class, which in our opinion is closer to Florida's theory since we left out people with

government occupations or in business administration (see above). But we have also applied our models following Florida's way of using his own (U.S.) population data (see appendix). According to this method, 35% of Dutch population belongs in the creative class (compared to 30% in the U.S.). Table 2 shows the results of the estimations with the creative class as defined by Florida.

A one-percentage-point increase in the share of Florida's creative class in a Dutch city means an average increase of employment growth rates with 0.86 percent (significance: 5.38) in the limited model, and 0.92 percent (t-value: 4.57) in the enlarged model. There are no significant differences between the results of the two different definitions of the creative class. The other variables in the models have also largely the same results as before.

Table 2 Creativity (Florida's definition, 1994) and employment growth (1994-2003) in Dutch cities

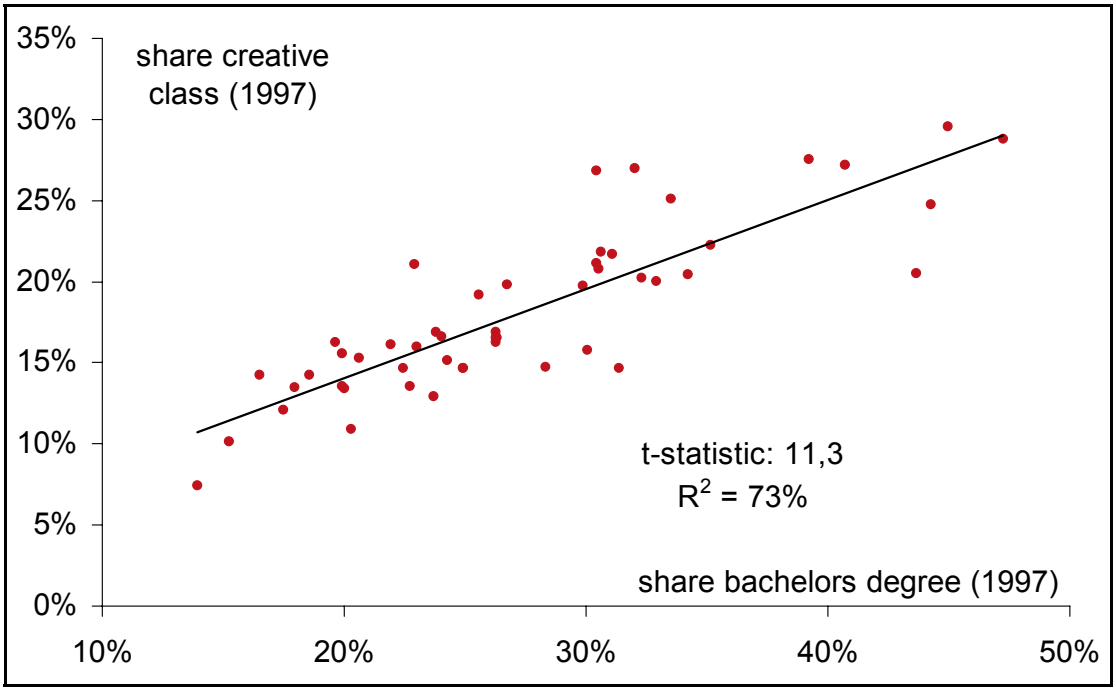
	Core cities				Fifty largest cities			
	limited (WLS)	extended (WLS)	instrumented (2SLS)		limited (WLS)	extended (WLS)	instrumented (2SLS)	
Creative class (as defined by Florida)	0,86 (5,38)***	0,92 (4,57)***	1,16 (3,50)***	1,29 (2,55)***	0,84 (5,76)***	0,68 (4,48)***	0,99 (3,55)***	1,01 (2,57)***
Population growth	1,23 (6,00)***	1,16 (4,98)***	1,22 (5,04)***	1,10 (4,76)***	1,50 (23,4)***	1,43 (26,3)***	1,45 (24,6)***	1,41 (28,3)***
Spatial lag creative class		-0,28 (-0,38)	0,04 (0,041)	0,62 (0,72)		0,65 (1,17)	0,44 (0,58)	0,83 (1,23)
Congestion		-0,09 (-1,73)*	-0,10 (-1,74)*	-0,16 (-2,80)***		-0,14 (-3,36)***	-0,12 (-2,43)**	-0,16 (-3,32)***
Diversity		-0,80 (-2,59)**	-0,76 (-2,37)**	-0,36 (-1,23)		-0,51 (-1,96)**	-0,57 (-1,92)*	-0,32 (-1,32)
Share manufacturing		-0,28 (-1,51)	-0,23 (-1,08)	-0,34 (-1,71)*		-0,41 (-3,31)***	-0,33 (-2,27)**	-0,45 (-3,54)***
Unemployment		0,44 (-0,55)	-0,30 (-0,64)	-0,37 (-0,66)		0,11 (0,33)	0,01 (0,02)	0,10 (0,24)
Spatial lag employment growth		0,42 (-1,45)	-0,67 (-1,24)	-0,085 (-0,18)		-0,45 (-1,46)	-0,63 (-1,48)	-0,28 (-0,83)
N	31	31	31	31	50	50	50	50
R^2 adj.	8,0%	34,7%	26,1%	34,6%	76,8%	83,3%	82,7%	83,9%

On the basis of the estimation results of the limited, the extended and the instrumented models of employment growth, we may conclude that Florida's creative class is indeed an important determinant for city growth in the Netherlands. However, this does not necessarily imply that creative class is a real novelty.

4. IS THERE ANYTHING NEW IN CREATIVITY?

According to Glaeser, Florida's creative capital theory is essentially the same as good-old Human Capital theory (see above). Figure 2 shows levels of creative class in Dutch cities to be in fact highly correlated with share of higher educated population (University or HBO; the latter is comparable to Anglo-Saxon polytechnics), supporting Glaeser's comment on Florida .

Figure 2 Creativity and education in Dutch cities



To test the education-skills-creativity relationship in more depth we have used the same models as before while leaving out creative class, which we replaced by education levels as an indication for human capital. The results appear in Table 3. Replacing creative class by levels of education does not change much in the economic importance of diversity, share of manufacturing and congestion forces. And just like creative class, the share of highly educated people correlates positively with employment growth. But coefficients and levels of significance are both significantly lower for education levels than for creative class. A one-percentage-point increase in the share of people with a Bachelors degree in Dutch cities means an average increase in employment growth rates with 0.66 percent (significance: 3.39) in the limited

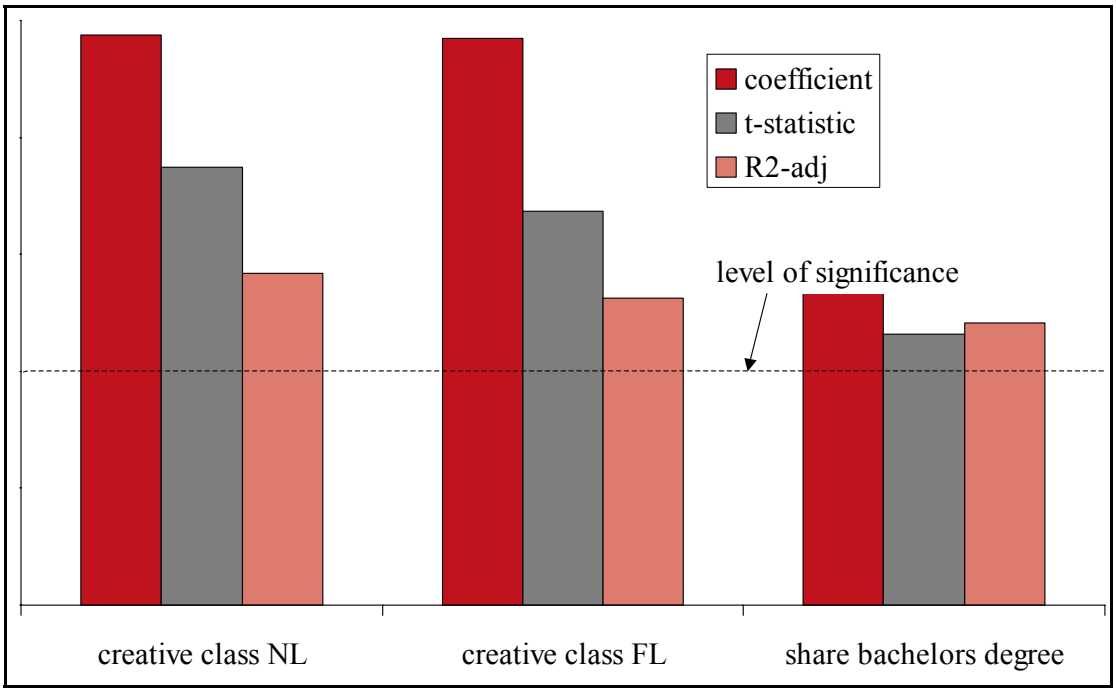
model and 0.62 percent (t-value: 2.99) in the enlarged model. In our creative-class models the coefficients were on average 0**.**9 (see tables 1 and 2).
When the bachelors are instrumented with our second set of instrumental variables, the level of significance (t-value: 1.66) is only just above the border of the acceptable ten percent significance level**;** the creative class instrumented in this way resulted in t-values far above 2 (see tables 1 and 2).

Table 3 Education (1994) and employment growth (1993-2004) in Dutch cities

	Core cities				Fifty largest cities			
	limited (WLS)	extended (WLS)	instrumented (2SLS)		limited (WLS)	extended (WLS)	instrumented (2SLS)	
Share bachelors degree	0,66 (3,39)***	0,62 (2,99)**	0,73 (2,81)***	0,53 (1,66)*	0,65 (3,99)***	0,55 (3,01)***	0,62 (2,65)***	0,47 (1,71)*
Population growth	1,31 (4,99)***	1,35 (4,61)***	1,28 (4,78)***	1,33 (4,33)***	1,60 (18,7)***	1,46 (22,7)***	1,47 (23,0)***	1,43 (24,4)***
Spatial lag share bachelors degree		0,85 (0,71)	0,10 (0,08)	0,76 (0,56)		0,91 (1,18)	0,44 (0,55)	0,68 (0,89)
Congestion		-0,13 (-2,06)**	-0,09 (-1,45)	-0,14 (-1,77)*		-0,13 (-2,70)***	-0,11 (-2,17)**	-0,13 (-2,34)***
Diversity		-0,76 (-2,18)**	-0,69 (-2,02)**	0,48 (-1,28)		-0,54 (-2,04)**	-0,54 (-2,03)**	-0,35 (-1,35)
Share manufacturing		-0,42 (-2,51)**	-0,33 (-1,80)*	-0,55 (-2,37)***		-0,44 (-3,58)***	-0,42 (-3,06)***	-0,57 (-3,93)***
Unemployment		-0,52 (-1,03)	-0,90 (-1,55)	0,40 (-0,61)		-0,26 (-0,57)	-0,50 (-0,99)	-0,24 (-0,45)
Spatial lag employment growth		-0,75 (-1,36)	-0,43 (-0,75)	-0,20 (-0,31)		-0,52 (-1,35)	-0,40 (-1,07)	-0,12 (-0,32)
N	31	31	31	31	50	50	50	50
R^2 adj.	7,4%	13,6%	20,6%	20,7%	78,1%	81,5%	81,3%	82,7%

Figure 3 summarizes our estimation results. The figure shows the average for all coefficients, significance levels and R-squares of the models presented in this paper. In all models growth is significantly better predicted by creativity than by education. On average our specifically Dutch creative class does slightly, but not significantly, better than Florida's creative class.

Figure 3 Average estimation results of different indicators for human capital



To test for the robustness of our estimation results we tried several other models, more or less different from the models presented here, but all being acceptable from a theoretical point of view. We estimated models for several periods of employment growth: 1993–2003, 1994–2003 and 1995–2003, while varying the model specification by leaving out congestion, diversity, share of manufacturing, unemployment and the spatially lagged variables one by one and in al possible combinations. This resulted in 64 models per period.

We estimated these 192 models (3 periods) for the creative class in both our and Florida's definition as well as for the share of bachelor's degree. For both definitions of the creative class we found significant coefficients, at the one-percent significance level. For the share of bachelors we found significant coefficients in 119 out of 192 model estimations (62%). Table 4 summarizes the average results of the 192 model estimations.

Table 4: Average results of 192 model estimations with skills and creativity

192 extended models on employment growth	Coefficient (average)	T-statistic (average)	Significant (10%)	Significant (1%)
Share creative class (NL)	0,67	5,9	100%	100%
Share creative class (Florida's definition)	0,67	4,9	100%	100%
Share bachelors degree	0,48	3,1	77%	62%

Overlooking and combining all the results presented here, we must conclude that creative class is a better predictor of employment growth than education is. For cities this means that attracting one member of the creative class will foster growth more effectively than attracting one highly educated person.

Edward Glaeser used a slightly different approach for testing Richard Florida's creative capital theory.[26] He included in one model both share of bachelors and Florida's so called 'super creative core': the hardcore, idea-creating part of total creative class. In Glaesers analyses education is the important and significant predictor for growth, not creative class (that means: the part he uses).
He then combines education levels with Florida's bohemians: people with artistically creative jobs such as artists, architects and designers, who according to Florida are economically the most important part of the creative class. Glaeser does find additional and significant correlations for these bohemians. But this bohemians-effect is "entirely driven by two metropolitan areas [Las Vegas and Sarasota]".
Finally, we included creative class and bohemians in our education-to-growth models, in the way Glaeser did. Table 3 showed our original results, with more or less significant coefficients for share of bachelors. Once we control in these models for the Dutch creative class (the entire category, not just the part Glaeser uses), the latter eliminates the significance of education, being very positively significant itself (see table 5). This means, again, that our creative class measure is more powerful than education is.
We repeated this operation for our Dutch bohemian-index (see Appendix for a definition). Our findings were quite similar to Glaeser's; a positive correlation between bohemians and employment growth (see table 5) but entirely caused by (in our case) one city: Amsterdam. Leaving Amsterdam out of the samples, both education levels and the bohemian index become insignificant. We finally combined creative class and bohemians in one model. In the sample with Amsterdam both creative class and bohemians are positively and significantly correlated with employment growth. Excluding Amsterdam form the sample makes no difference for

[26] Glaeser, Review.

the creative class, leaving the bohemian index irrelevant. We found the same results for our sample of 31 core cities.

The bohemians effect is in our (and Glaeser's) opinion less powerful than Florida suggests. In the Dutch case the bohemian-index is at best a good proxy for the extraordinary position of Amsterdam among Dutch cities.

Table 5 Combining education, creative class and the bohemian index

	Fifty largest cities				
(WLS)	G50	G50	ex A'dam	G50	ex A'dam
Share bachelors degree	-0,02 (-0,11)	0,11 (0,80)	0,23 (1,52)		
Creative class NL	0,73 (3,57)***			0,30 (1,66)*	0,40 (2,17)**
Bohemians		28,6 (6,37)***	-7,79 (-0,36)	20,9 (3,59)***	-13,5 (-0,60)
Population growth	1,43 (25,5)***	1,52 (26,5)***	1,50 (25,1)***	1,49 (27,3)***	1,46 (25,7)***
Spatial lag	0,11 (0,15)	-0,27 (-0,39)	0,26 (0,38)	0,23 (0,28)	-0,08 (-0,11)
Congestion	-0,09 (-1,89)*	-0,10 (-2,30)**	-0,10 (-2,37)**	-0,09 (-2,13)**	-0,08 (-1,81)*
Diversity	-0,35 (-1,51)	-0,13 (-0,55)	-0,17 (-0,72)	-0,16 (-0,68)	-0,16 (-0,71)
Share manufacturing	-0,40 (-3,06)***	-0,40 (-2,94)***	-0,44 (-3,25)***	-0,39 (-3,04)***	-0,44 (-3,31)***
Unemployment	-0,45 (-1,25)	-0,75 (-2,39)**	-0,71 (-2,29)**	-0,67 (-1,88)*	-0,68 (-1,92)*
Spatial lag employment growth	-0,28 (-0,78)	-0,48 (-1,29)	-0,32 (-0,73)	-0,42 (-1,20)	-0,16 (-0,36)
N	50	50	50	50	50
R^2 adj.	83,0%	82,8%	83,4%	83,6%	84,2%

We found that creative class is a better predictor for local employment growth then share of bachelors. We also found that human capital measured by education levels does matter, but no longer so while we control for the creative class. Does this mean that human capital is no longer important and should be replaced by creativity?

We therefore return to the definition of human capital: Human capital is the amount of knowledge and skills of an individual (individual human capital). The level of human capital in a certain location is the sum of the human capital of all individuals living and/or working in this place.

In this definition creative capital is nothing new since creativity is part of individual skills and creative capital thus part of (or equal to) human capital. But as we have

seen, creative class is a better predictor for employment growth than education. Members of the creative class are essentially working, but not necessarily highly educated, while highly educated people are not necessarily doing any work at all. Highly educated people might end up without jobs after studies, or choose for easy routine jobs, leaving their human capital largely unused.
Individual human capital could be equal after studies (education levels) but then grow through work in creative jobs. Levels of human capital can therefore be higher in places with more people working in creative jobs than in places with the same levels of education but less people working in creative jobs – not only because individual levels of skills and knowledge grow, but because everyone is making more and better use of other people's knowledge. This means that the use of human capital may be more productive in places where more highly educated, creative people are living and working. Equal levels of human capital can, in other words, have different production outcomes due to different ways in which human capital is actually used: 'working human capital' is more productive than 'non-working human capital'.
We suggest that it is not creativity in the sense of painting or making sculptures that makes Florida's creative class responsible for regional growth differences. In our view creativity is *the creative use of skills and knowledge*. Defining creativity in this way makes the creative class an indicator for human capital.

Our overall conclusions are that Creative Class is theoretically much the same as Human Capital. To that extent we agree with Glaeser's comment on Florida's popular book. At the same time, the Creative Class standard – and this is precisely what Florida said in his 'Response tot Edward Glaeser's review' – is in the Dutch case "a slightly better handle on actual skills, rather than using only an education-based measure – to measure what people do, rather than just what their training may say about them on paper".[27] By introducing the concept of Creative Class Richard Florida has found better standards for measuring human capital than the often-used education levels, this being his major (perhaps only) contribution to a better understanding of regional growth.

[27] Florida, Response (2004), p. 2.

5. THREE POSSIBLE MECHANISMS THAT ENABLE HUMAN CAPITAL TO FOSTER GROWTH

Measuring human capital by creative class leads to the conclusion that Dutch cities with more human capital grow faster than cities with less human capital. With a better standard for human capital it might be easier to find empirical answers on some of the remaining questions about the connection between human capital and economic growth. In this chapter we present some first results of our attempt to explore the economic mechanisms behind the human capital theory. This is largely an intermezzo, which means that readers may easily skip this chapter and go on to chapter 6 for an overview of the major conclusions of the analyses presented so far in this paper.

According to Florida and others there are at least three possible explanations for the human capital link to growth.

First of all, a concentration of creative and highly educated people in a place accumulates creativity and knowledge, making all the people in such locations more productive as workers in existing local industries. As a result local firms grow faster and more firms are attracted to those places.

Black and Lynch have found, on the level of private establishments, an 8.5% productivity growth in manufacturing and a 12.7% productivity growth in non-manufacturing for each 10% rise in the average education level of workers.[28] Human capital thus encourages the growth of existing, mature firms in cities and regions.[29]

In exploring this human capital effect, most attention is given here to the high-tech and ICT sectors, on the assumption that technological innovation is the most important benefit of skilled and educated people. But human capital is not only about technological and product innovations that foster technological production and manufacturing. Human capital also stimulates process innovation and the use of cost-cutting technologies in the service sector.[30] We would suggest that Silicon Valley-like employment boosts have been less important in the Netherlands as compared with the U.S. We expect other Dutch sectors to benefit most from human capital.

[28] S. E. Black & L. M. Lynch, 'Human capital investment and productivity', *American Economic Review* LXXXVI (1996), pp. 263–267.
[29] Mathur, 'Human-capital based strategy'.
[30] S. Klepper, 'Entry, exit, growth and innovation over the product life cycle', *American Economic Review* LXXXVI (1996), pp. 562–583.

A special form of the productivity view of human capital says that regions with an industrial structure and high levels of human capital are better able to shift their industrial structure towards growing industries than regions or cities with an industrial structure and a lack of human capital. The so-called reinvention view of human capital says that highly educated, creative people adapt more easily to change and new ideas and technologies. [31]

In our enlarged models (see above) we found both a lack of diversity and a high share of employment in manufacturing negatively correlated to employment growth. On the other hand we found a positive relationship between human capital and employment growth. In The Netherlands, cities with high shares in manufacturing and low diversity are doing worse than diversified economies. But economies with high shares of manufacturing that lack diversity grow faster when they have larger endowments of creative and skilled labor than industrial economies with smaller stocks of human capital. Although we should extend our models with cross-terms for testing this specific mechanism, these results are quite hopeful as supports for the reinvention view of human capital.

Human capital is in theory not only responsible for the growth of mature companies. Creative and highly educated people also tend to start more new companies. A larger stock of human capital in a region is "a pool for" Schumpeterian entrepreneurs, and thus for more new business startups.[32] There is empirical evidence that U.S. regions with more skilled technical labor show higher birth rates of new firms[33] and that new firms survive longer when headed by more educated entrepreneurs.[34] More skilled and creative people are thus a more productive labor force for mature firms and are more willing to start up new companies.

Our third and last connection of human capital to growth is through spending. Creative and highly educated people have higher incomes and participate more in city life, which means they spend a larger share of their incomes in local bars, restaurants and theatres, creating amenities and quality-of-place and stimulating employment

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[31] Glaeser & Saiz, *Rise of the Skilled City*, p. 2.
[32] Mathur, 'Human-capital based strategy', p. 213.
[33] D. W. Carlton, 'Why men locate where they do: An econometric model', in: W. C. Wheaton (ed.), *Interregional Movement and Regional Growth* (Urban Institute, Washington DC 1997) pp. 13–50.
[34] T. Bates, 'Entrepreneur human capital inputs and small business longevity', *Review of Economics and Statistics*, LXXII (1990), pp. 551–559.

growth in local services.[35] In a cross-section of U.S. cities Henderson shows that in cities with high levels of human capital, there is more employment for unskilled labor.[36]

Our final aim for this paper is to find out which mechanism – productivity, startups or spending – is responsible for the growth effect we found. We present some first results of estimations to test for the mentioned mechanisms. In testing the connection between human capital and new business creation we tried to differentiate between growth of mature firms and startups. If the latter finds a creativity effect, mechanism two (highly educated people tend to start up new companies) is true.
In repeating the same models for employment growth on a sectoral scale, we tried to find some first evidence of spending versus productivity, and of productivity due to technological innovation versus productivity growth in services. If we find creative class being positively related with employment growth in manufacturing, we think of technological progress as a major benefit of human capital. If we find employment effects in services we assume that process innovation and cost-cutting technologies are important.If , finally, we find that local services are benefiting from creative class we suggest spending is a powerful growth effect of high levels of creative, highly educated people in the city.

Table 6 shows the results of our estimations on sectoral employment growth and newly started companies. There is convincing evidence of a human capital effect on commercial services: a one percent-point growth in share of creative class means a 1.0% increase in employment growth in commercial services. This is especially due to employment growth in financial services as a part of total commercial services: one percent more creative class results in 3.66% employment growth in financials. This supports the view that higher productivity due to innovations in services is a result from human capital.

[35] E. L. Glaeser, J. Kolko & A. Saiz, *Consumer City* (Working paper series, Nr. 7790, Cambridge Mass., National Bureau of Economic Research 2000).
[36] J. V. Henderson, *Urban Development* (Oxford University Press, New York 1988).

Table 6 Human capital, sectoral employment growth and startups

Employment growth in:	Manu-facturing	Commer-cial services	Non-commercial services	Financials	Local services	New business startups (average 1995-2003)
	(1)	(2)	(3)	(5)	(6)	(7)
Share creative class (NL)	1,71 (1,7)*	1,00 (2,5)**	-0,31 (-0,7)	3,66 (3,3)***	0,18 (0,35)	21,50 (2,8)***
Population growth (1994-2003)	1,44 (11,7)***	1,60 (22,4)***	1,54 (12,3)***	2,99 (6,8)***	1,12 (9,90)***	
Congestion	5,3E-4 (1,5)	-7,5E-4 (-4,9)***	-2,1E-4 (-1,6)*	-6,6E-4 (-1,5)	-6,4E-4 (-2,9)***	1,5E-4 (0,1)
Diversity	0,09 (0,1)	-0,68 (-1,2)	-1,24 (-2,5)**	-3,93 (-2,3)**	-1,09 (-1,93)**	-1,3E+1 (-1,5)
Share manu-facturing	0,07 (0,2)	0,41 (1,9)*	-0,02 (-0,1)	-0,03 (0,0)	0,31 (1,18)	1,77 (0,4)
Share business and financial services	-1,19 (-1,2)	-0,30 (-0,5)	0,02 (0,0)	-3,64 (-1,8)*	-0,96 (-1,31)	3,93 (0,4)
Unemploy-ment	0,72 (0,7)	-0,23 (-0,3)	-0,67 (-0,8)	0,69 (0,3)	-0,14 (-0,16)	5,4E+1 (3,0)***
Spatial lag creative class	-2,13 (-0,8)	1,34 (1,1)	0,78 (0,6)	0,21 (0,0)	-0,13 (-0,06)	
Spatial lag employment growth	0,12 (0,2)	-1,37 (-2,0)**	-1,10 (-1,1)	-1,63 (-1,6)*	-2,47 (-1,93)*	0,94 (1,8)*
N	50	50	50	50	50	50
R^2 Adj.	32,7%	56,2%	50,1%	29,4%	42,6%	23,9%

There is so far no support for the spending thesis on human capital. No significant correlation between creative class and employment growth in local services (shops, cafés and restaurants) emerges from our estimation. Before concluding this spending effect to be absent, we should first make our models better suitable for testing for this effect. We expect, in contrast with the productivity mechanism, that it is not *shares* of creative class that predict employment growth due to spending, but *growth* of the creative class.

Employment growth in non-commercial services (education, health care, government) is clearly not significantly influenced by human capital. The connection between creative class and manufacturing is on the threshold of acceptable significance, the sign being positive. When the latter is really true (what we continue to test for) we may conclude that it is through technological and process innovation that human capital results in an increased productivity of mature firms.

Our major finding is that what matters is not just productivity growth in mature firms. Our estimation results provide convincing evidence that skilled and creative people are more willing to start up new companies. A one percent-point increase in the share of creative class raises the amount of newly started companies with 22 for each one thousand people in the labor force. As it is reasonable to suggest that people who start up a new company will do so mainly in the city where they live, this result could also help us understand why we found a strong relationship between creative class and total employment growth within cities, but hardly any regional effects due to urban concentrations of creative, skilled people.

6. CONCLUDING REMARKS

Richard Florida in his popular book *The Rise of the Creative Class* has suggested that there is a new, economic growth enhancing mechanism in agglomerating people in cities. It is not only knowledge accumulation that matters, but creativity and a bohemian lifestyle.

With our Dutch dataset we do find evidence that Florida's creative class is a better predictor of city growth than traditional education standards. Therefore we conclude that Florida's major contribution is his successful attempt to create a population category that is a better indicator for levels of human capital than average education levels or amounts of highly educated people. The point is, as Florida stated, not which or how much education people can boast of, but what they really do in working life. Using this standard for human capital we find that in Dutch cities higher levels of human capital are correlated to employment growth. This is largely due to employment growth in commercial, mainly financial, services and to newly started companies. We conclude that both a highly productive labor force and the right atmosphere to start up new businesses emerge in places with high levels of skilled and creative people. But we doubt if this has anything to do with bohemianism, or creative ethos, other than social interaction as meant in the Human Capital theory.

Florida has claimed another, even 'key', original contribution for his work.[37] This key contribution is the answer to the question why some cities are able to attract and retain highly educated and creative people while others are not. Florida's answer is not amenities,[38] but openness or tolerance.

We are currently working this out with a large dataset of amenities, tolerance and other possible preferences for Dutch cities. The first results suggest that it may not be Florida's tolerance but Glaeser's amenities – such as culture, environmental beauty and, as a typical Dutch amenity, the amount of historic buildings – which are most likely to attract creative class to Dutch cities.

Although this is work-in-progress, these amenities are used as instrumental variables to instrument creative class and the shares of highly educated people in the growth models presented above, and are thus confirming our conclusions that the creative class is responsible for urban employment growth in The Netherlands.

[37] Florida, Response (2004).
[38] Glaeser, Kolko & Saiz, *Consumer City*, pp.27–50.

APPENDIX

The construction of the Dutch creative class

As said in the main text we used a more limited definition of the creative class than the one Florida used. We actually constructed two versions of the Dutch creative class: one exactly the way Florida defined it, and one according to our own definition. Florida's creative class contains:

- Computer and mathematical occupations
- Architecture and engineering occupations
- Life, physical, and social science occupations
- Education, training, and library occupations
- Arts, design, entertainment, sports, and media occupations
- Management occupations
- Business and financial operations occupations
- Legal occupations
- Healthcare practitioners and technical occupations
- High-end sales and sales management.[39]

Florida's description served as a guide in selecting the creative class occupations from the list of occupations used by the Dutch bureau of statistics (CBS-SBC92).[40] The construction of the creative class in Florida's definition keeps 659 occupations out of the 1211 occupations available in the SBC92 classification (see table A1).
A critical analysis of Florida's definition of the creative class led us to use a more restricted definition. For example most jobs in government were left out, as well as managerial occupations in sectors where no intensive innovation is expected. The narrower definition keeps 389 out of the total of 1211 jobs. The major differences between the two approaches are listed in table A1.

[39] Florida, *Rise of the Creative Class,* p. 328.
[40] SBC92 = *Standaard Beroepen Classificatie 1992* = Standard Occupation Classification 1992.

Table A1 Occupations belonging to the two definitions of the creative class

Classes of occupations	Number of jobs in the class	Florida's definition	Our definition	Typical examples of excluded occupations
lower level general occupations	10	50%	40%	Sportsmen
lower level mathematics and natural sciences occupations	2	100%	0%	
lower level technical occupations	105	2%	0%	
lower level clerical and commercial occupations	28	4%	4%	
intermediate level agricultural occupations	33	15%	15%	
intermediate level mathematics and natural sciences occupations	5	100%	100%	
intermediate level technical occupations	183	20%	10%	Managers of building, confection and electrotechnical companies
intermediate level transport occupations	25	12%	0%	
intermediate level clerical and commercial occupations	66	26%	11%	Production planners and office managers
intermediate level legal, public administration and security occupations	11	45%	0%	
intermediate level occupations in humanities, documentation and fine arts	10	60%	40%	Archivist
intermediate level occupations in home economics and service trades	24	8%	0%	
higher level teachers and educationalists	29	93%	7%	Teachers in primary and secondary schools
higher level agricultural occupations	16	81%	44%	Civil servants
higher level mathematics and natural sciences occupations	9	100%	67%	Civil servants
higher level technical occupations	91	97%	69%	Inspectors
higher level transport occupations	12	100%	0%	
higher level medical and health-related occupations	17	94%	65%	Ward-sisters and -masters
higher level commercial occupations, occupations in business	64	100%	58%	Managers and assistant accountant
higher level legal, public administration, and security occupations	26	100%	8%	Managing civil servants and inspectors
higher level occupations in humanities, documentation and fine arts	26	100%	88%	Civil servant
higher level social and behavioral occupations and related occupations	30	100%	77%	Civil servant
higher level occupations in home economics	3	100%	0%	
higher level managers	16	100%	19%	Managers in hotels, restaurants, primary education and transportation occupations
academic level teachers and educationalists	32	100%	66%	Teachers in secondary schools and civil servant
academic level agricultural occupations	15	100%	73%	Civil servant

academic level mathematics and natural sciences occupations	5	100%	80%	Civil servant
academic level technical occupations	51	100%	82%	Civil servant
academic level medical and health-related occupations	28	100%	93%	Civil servant
academic level commercial occupations, occupations in business	28	100%	71%	Accountants and managers
academic level legal, public administration, and security occupations	30	100%	27%	Inspectors and managing secretary government agencies
academic level humanities, social and behavioural occupations and	35	100%	77%	Civil servant
academic level managers	16	100%	56%	Managers in secondary education, housing association

The Dutch Bohemian-index

A small but, in Florida's view, important part of the creative class are the bohemians: artistically creative people. In Florida's definition the Bohemian-index includes:

- authors
- designers
- musicians and composers
- actors and directors
- painters and sculptors
- photographers and artist printmakers
- dancers
- artists and performers[41]

We used the same definition to construct the Dutch bohemian-index, but different sources from those we used to construct the creative class. Local and regional data on the presence of artistic jobs are not available at the Dutch bureau for statistics. Therefore, an alternative source was used: the membership lists of various unions united in the Federation of Dutch artists unions. This federation is comprised of 21 unions with each union focusing on a specific skill or activity. Not all memberships have been included. Some membership lists were not available and some of the

[41] Florida, *Rise of the Creative Class,* p. 333

unions were considered to be less relevant for the construction of the bohemian-index. The bohemians included in our Dutch bohemian-index are:

- designers
- visual artists
- photographers
- interior architects
- composers
- dancers
- authors
- sculptors and ceramic artists

The number of memberships collected was almost 14,000. Of course, not all artists are union members. Therefore, the national number of these artists is taken from the Dutch bureau of statistics (CBS) and used to rescale the number of memberships of the federation (factor is about 4). This rescaled number of artists divided by the size of the population results in a local bohemian index.

Samples of cities

In our regressions we used two samples of cities. The first sample contains the 50 largest Dutch cities (G50), the second sample 31 so-called core cities.[42] In table A2 and figure A1 we have listed and mapped the cities included in these two samples.

Table A2 List of cities used in the regressions

Cities	G50	K31
Alkmaar	X	X
Almelo	X	X
Almere	X	
Alphen aan den Rijn	X	
Amersfoort	X	X
Amstelveen	X	
Amsterdam	X	X
Apeldoorn	X	X
Arnhem	X	X

[42] Based on: Van Oort, Agglomeration

Bergen op Zoom	X	
Breda	X	X
Delft	X	X
Den Haag	X	X
Deventer	X	X
Dordrecht	X	X
Ede	X	
Eindhoven	X	X
Emmen	X	
Enschede	X	X
Gouda	X	
Groningen	X	X
Haarlem	X	X
Haarlemmermeer	X	
Heerlen	X	X
Helmond	X	X
Hengelo (O.)	X	X
Hilversum	X	X
Hoorn	X	
Leeuwarden	X	X
Leiden	X	X
Leidschendam-Voorburg	X	
Lelystad	X	
Maastricht	X	X
Nijmegen	X	X
Oss	X	
Purmerend	X	
Roosendaal	X	
Rotterdam	X	X
Schiedam	X	
‘s-Hertogenbosch	X	X
Sittard-Geleen	X	X
Spijkenisse	X	
Tilburg	X	X
Utrecht	X	X
Velsen	X	X
Venlo	X	X
Vlaardingen	X	
Zaanstad	X	
Zoetermeer	X	
Zwolle	X	X
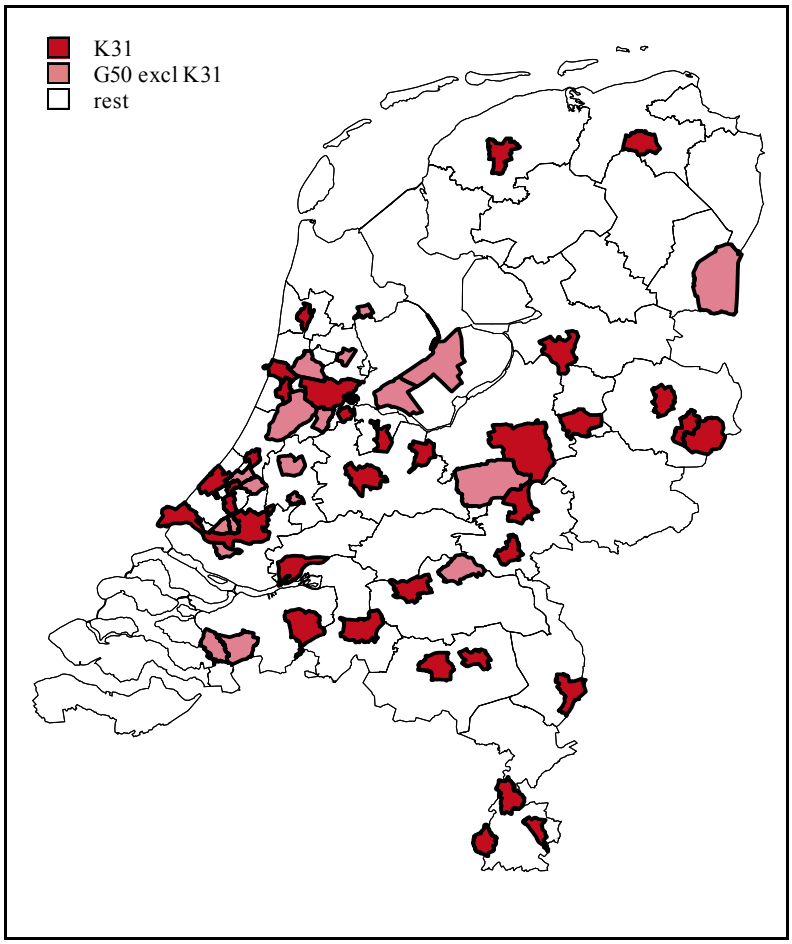
Figure A1 Map of cities used in the regressions