

How do regulated and unregulated labor markets respond to shocks?

Evidence from the Great Recession*

Sergei Guriev, Biagio Speciale and Michele Tuccio

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Abstract

We study wage adjustment during the recent crisis in formal and informal labor markets in Italy. We use a unique survey of immigrant workers that allows us to control for occupation, education, gender, age, year of arrival to Italy and country of origin. We show that before the crisis wages in the formal and informal sector moved in parallel (with a 18 percent premium in the formal sector). During the crisis, however, formal wages did not adjust down while wages in the informal sector fell so that by 2012 the gap has grown to 35 percent. The difference is especially salient for workers in “simple” occupations where there is high substitutability between immigrant and native workers. Our results are consistent with the view that labor market regulation prevents downward wage adjustment during recessions.

*Guriev: Department of Economics, Sciences Po, Paris, and CEPR. Speciale: University of Paris I. Tuccio: University of Southampton. The authors are grateful to seminar participants in Fudan.

1 Introduction

The Great Recession has brought a substantial increase in unemployment in Europe. Overall, unemployment rate in the euro area has grown from 8 percent in 2008 to 12 percent in 2014. The change in unemployment has been very heterogenous. In northern Europe, unemployment did not grow substantially or even fell: in Germany, for example, unemployment rate has actually declined from 7 to 5 percent. At the same time, in Greece unemployment has grown from 8 to 26 percent, in Spain — from 8 to 24 percent, and in Italy — from 6 to 13 percent.

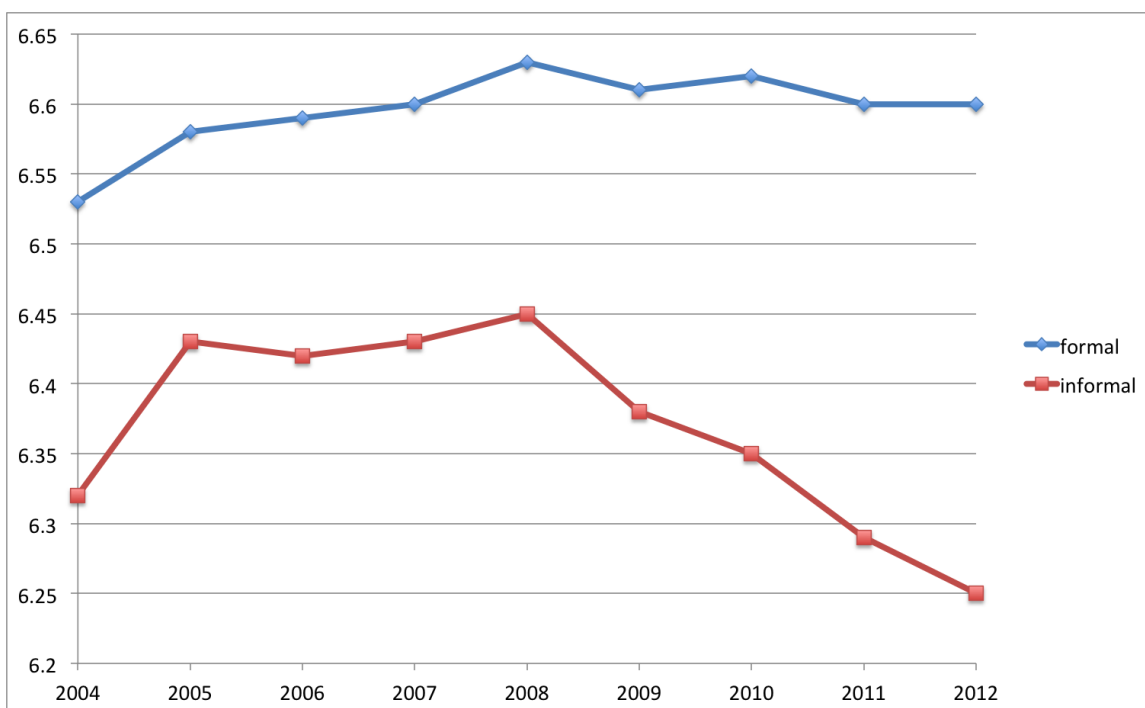
Why has unemployment dynamics been so different in European countries? The most common explanation is the difference in labor market institutions that prevents wages from adjusting downward. If wages cannot decline, negative aggregate demand shocks (such as the Great Recession) result in growth of unemployment. On the other hand, if wages can fall, labor markets find a new equilibrium with unemployment rates returning to normal levels. Adjustment of nominal wages in response to macroeconomic shocks is especially important in the euro area where wages cannot adjust through exchange rate depreciation; on the other hand, labor mobility among EU countries is limited (unlike, for example, the mobility of labor across US states).

While this argument is straightforward, it is not easy to test empirically. Cross-country studies of labor markets are subject to comparability concerns. The same problems arise in comparing labor markets in different industries within the same country. In order to construct a convincing counterfactual for a regulated labor market, one needs to study a non-regulated labor market in the same sector within the same country. This is precisely what we do in this paper through comparing formal and informal markets in Italy over the course of 2004-12.

We use a unique dataset, a large annual survey of immigrants working in Lombardy carried out by ISMU Foundation since 2004. Lombardy is the largest region of Italy in terms of population (10 million people, or one sixth of Italy's total) and GDP (one fifth of Italy's total GDP). It is also the region with the largest migrant population: in 2005, 23 percent of the entire migrant population legally residing in Italy were registered in Lombardy. It is also likely to be the largest host of undocumented migrants: in the last immigrants' regularization program in 2002, Lombardy accounted for 22 percent of amnesty applications.

While Lombardy has higher GDP per capita and lower unemployment than Italy on average, it has also suffered from the recent crisis. Unemployment increased from 4 percent in 2008 to 8 percent in 2012. Recession started in 2009, was followed by a weak recovery in 2010-11 and resumed in 2012; in 2012 real GDP was 5 per cent below its 2008 level.

Figure 1: Wages in formal and informal sector in Lombardy.



The vertical axes: logarithm of wages controlling for sector of employment, gender, age, education, country of origin, family characteristics. Source: ISMU survey, authors' calculations.

Our data cover 4000 full-time workers every year; one fifth of them works in the informal sector. The dataset is therefore sufficiently large to allow us comparing the evolution of wages in the formal and in the informal sector controlling for occupation, skills and other individual characteristics (age, gender, year of arrival to Italy and country of origin). We use the difference-in-differences methodology. Our main hypothesis is that a large recession in Italy (and Lombardy) should have resulted in a larger decline of wages in the unregulated labor market (i.e. in the informal sector) relative to the regulated labor market (the formal sector).

Our main result is presented in Figure 1. We do find that the wage differential between formal and informal sector has increased after 2008. Moreover, while the wages in the informal sector decreased by about 20 percent in 2008-12, the wages in the formal sector virtually did not fall at all. This is consistent with the view that there is substantial downward stickiness of wages in the regulated labor markets. Interestingly, before the recession, wages moved in parallel in the formal and the informal sectors — both regulated and unregulated labor markets have a similar degree of *upward* flexibility of wages.

The conventional wisdom relates the downward stickiness of wages to the minimum wage regulation. This relationship cannot be through randomized control trials; nor we are aware of the natural experiment that would include a change in minimum wages. Instead, we use the fact that minimum wages in Italy are sector-specific. We find that the effect in Figure 1 is similar in occupations where the average wage is close to minimum wage and in those where the average wage is far above the minimum wage. Therefore minimum wages do not seem to explain the downward stickiness of wages in the formal labor market.

We also check whether the effect is stronger in “simple” rather than “complex” occupations. The former require generic skills and allow for greater substitutability between workers (in particular, between natives and immigrants) within occupations and across occupations. In such occupations we should expect a greater downward adjustment in the absence of regulation. On the contrary, in the complex occupations, workers have specific skills and are harder to replace; therefore even in unregulated labor markets wages may not decline during recession. This is exactly what we find: the increase in the wage differential between the formal and informal sector during the recession is stronger in simple rather than complex occupations.

Our paper contributes to several strands of the literature. First, there is a literature on the labor markets’ responses to recessions and the respective channels of adjustment. The seminal paper by Blanchard and Katz (1992) studies the reaction of the US economy to regional shocks and shows that inter-state labor mobility is the major channel of adjustment in the long run. After seven years local economies adjust to aggregate demand shocks in terms of labor force participation and unemployment rates; the workers who cannot find jobs in the depressed states move out to other states. Decressin and Fatas (1995) carry out similar analysis for European regions and find that the adjustment mechanisms in Europe are different. European workers are less mobile than their American counterparts; in Europe, adjustment mainly occurs through reduced labor force participation. Mauro and Spilimbergo (1999) also consider the case of a European country, Spain, but argue that the adjustment mechanisms differ across skilled groups. They show that high-skilled Spanish workers respond with migrating from the depressed provinces while the low-skilled drop out of labor force or remain unemployed.

The analysis of the heterogeneity of the workforce and therefore of the labor market adjustments has greatly benefitted from the development of measures of skill content of occupations by Autor et al. (2003), Peri and Sparber (2009), Goos et al. (2009), Goos et al. (2014). We use these measures to disaggregate the channels of adjustment in our data.

There is also a large literature using difference-in-differences approach to analyze the impact of labor market institutions on employment. In particular, the seminal paper by Card and Krueger (1994) compares

the employment evolution in New Jersey after a 20 percent increase in the minimum wage with neighboring Pennsylvania (where the minimum wage does not change). They find no impact of minimum wage on employment in fast-food restaurants. More recently, Bentolila et al. (2012) compare labor market institutions in France and Spain and try to explain the strikingly different evolution of unemployment during the Great Recession in the two countries. The unemployment rates were around 8 percent in both France and Spain just before the Great Recession; subsequently the unemployment rate has increased to 10 percent in France and to 23 percent in Spain. The authors explain the differential by the larger gap between the firing costs of permanent and temporary contracts, and the laxer rules on the use of the latter in Spain. The issue of the dual labor market in Europe is discussed in detail in Boeri (2011) who provides a comprehensive survey of the literature of the impact of recent labor market reforms in Europe. Our paper also considers dual labor markets although we study the duality of formal vs. informal markets rather than that of permanent vs. temporary contracts. Another study of the role of the labor market adjustment during the Great Recession is Elsby et al. (2015) who analyze the experience of the US and the UK. They find that nominal wage rigidity did place a role in the US during the Great Recession but not in the UK.

Since our data only include immigrants we cannot directly compare the impact of the recession on immigrants with the effect on native workers. However, we use the main insights from the literature on the impact of immigration on wages and employment of natives and on the evolution of labor market outcomes of immigrants vs. natives through the business cycle. Orrenius and Zavodny (2010) compare the impact of the Great Recession on Mexican-born immigrants and native US workers with similar characteristics. They find that immigrants' employment and unemployment rates are particularly affected by the recession; the impact is especially strong for low-skilled and illegal immigrants. The authors also argue that one of the major channels of adjustment is a great reduction of the inflow of Mexican immigrants during the recession. Cadena and Kovak (2015) show that Mexican-born immigrants help to equalize spatial differences across local US labor markets. Interestingly, this takes place in both high-skilled and low-skilled segments of the labor market. The low-skilled immigrants turn out to be very responsive to labor market shocks which helps to equilibrate local labor markets even though low-skilled natives are not mobile. Cortes (2008) and Manacorda et al. (2012) study the impact of immigration on the wages of natives and find that these are immigrant and native workers are imperfect substitutes, especially in high-skilled occupations.

The rest of the paper is structured as follows. Section 2 discusses our empirical methodology. Section 3 introduces the data. Section 4 presents the results. Section 5 concludes.

2 Methodology

We adopt a difference-in-differences methodology and evaluate the differences in behavior of wages in the formal and informal sector before and after the 2008 crisis by estimating the following equation:

$$W_{iocpt} = \alpha Informal_i + \beta Crisis_t Informal_i + \gamma X_i + \delta_o + \delta_c + \delta_p + \delta_t + \varepsilon_{iocpt} \quad (1)$$

Here W is the logarithm of after-tax wage of a full-time employed worker i from country of origin c working in occupation o and residing in province p at the time of the interview ($t = 2004, \dots, 2012$). We include dummy variables δ_o , δ_c , δ_p , and δ_t for occupations, countries of origin, provinces and years fixed effects, respectively. Furthermore, control variables X_i include gender, age, age squared, years in Italy, education, married dummy, children abroad, children in Italy.

Our main variables of interest are $Informal_i$ (dummy for the employment in the informal sector) and $Crisis_t Informal_i$ — the interaction term for $Informal_i$ and $Crisis_t$. The latter is the dummy for years after 2008: $Crisis_t = \mathbf{1}(t > 2008)$.¹ As the informal labor market is unregulated, we should expect $\beta < 0$ — the wages in the informal sector should adjust downward to a greater extent during the crisis than in the regulated formal sector.

In order to check whether the identifying assumption of the parallel trends holds, we also estimate the following regression:

$$W_{iocpt} = \alpha Informal_i + \sum_{t=2004}^{t=2012} \beta_t \delta_t Informal_i + \gamma X_i + \delta_o + \delta_c + \delta_p + \delta_t + \varepsilon_{iocpt} \quad (2)$$

If the parallel trends assumption holds, then the coefficients β_t for $t < 2008$ must not be significantly different from β_{2008} . In other words, the wage differential between formal and informal sector should be constant before the crisis. Importantly, an advantage of using the difference-in-differences approach is that our results remain unbiased if potential endogeneity derives from unobserved differences between formal and informal workers that remain constant over time.

In order to understand what drives the wage adjustment or the lack thereof, we also investigate the heterogeneity of treatment effects. First, we split occupations into those where the minimum wage is likely to be binding and those where wages are safely above the minimum wage. For each occupation we calculate the average pre-crisis wage in 2007 and divide it by the occupation-specific minimum wage. We then rank

¹We also consider alternative proxies for $Crisis$ using $Crisis_t = \mathbf{1}(t > 2009)$ (assuming that the crisis started a year later) and $Crisis_{tp} = Unempl_{tp}$ (taking the unemployment rate in the province in a given year — controlling for year and province dummies).

occupations by the ratio of average wage to minimum wage and estimate regression (1) separately for the ratio above and below the median. If the minimum wage prevents downward adjustment of wages in the formal sector, we should find a stronger effect (a more negative β) in those occupations where wages before the crisis were not too far from the minimum wages.

We also distinguish between simple versus complex occupations. We assume that simple occupations involve generic skills; therefore there is a greater extent of substitutability between workers (including immigrant and native workers) within such occupations — as well as across such occupations. Therefore in the absence of regulation, such occupations should undergo a more substantial downward wage adjustment during recession. On the other hand, in complex occupations, skills are more specific and workers are less substitutable. In the complex occupations even unregulated labor markets may not see large drops in wages in times of recession and high unemployment. Therefore we should find a stronger effect (a more negative β in (1)) for simple rather than complex occupations.

3 Data

Our main database comes from the annual survey of immigrants undertaken by an independent Italian non-profit organization called ISMU (Initiatives and Studies on Multi-Ethnicity) Foundation. This is a large and representative sample specifically designed to elicit the truthful reporting of both documented and undocumented immigrants residing in Lombardy and working in both formal and informal sectors.² The ISMU dataset adopts an intercept point survey methodology where the first step involves listing a series of locations typically frequented by immigrants (such as religious sites, ethnic shops, or healthcare facilities), while in a second step both meeting points and migrants to interview are randomly selected. At each interview, migrants are asked how often they frequent the other meeting points, which permits to compute ex-post selection probabilities into the sample. With such approach, the ISMU survey produces a representative sample of the total migrant population residing in Lombardy.³

Table 6 in the Appendix presents the background of migrants working in the formal sector (regular workers) and the informal sector (irregular workers) as well as into legal (documented) and illegal (undocumented)

²It is worth noting that, although ISMU collaborates with the directors of aggregation centers which are usually trusted by most immigrants, the information on the immigrant's legal status is subject to misreporting. Nonetheless, Accetturo and Infante (2010) estimate the extent of misreporting to be quite small. They in fact compare ISMU's data with the other only reliable source of information on illegal migrants in Italy: the applications for regularization under the national amnesty of 2002. In that year, 31 percent of the total foreign population in Lombardy applied to regularization (and hence was irregular). Remarkably, the ISMU's estimates do not appear to be far off this figure: in the 2002 wave, self-declared illegal aliens represented 27 percent of the sample.

³See Dustmann et al. (2014) and Fasani (2015) for a description of these data.

immigrants. About 10 percent migrants are undocumented; 97 percent of them work in the informal sector of the economy.⁴ However, approximately 10 percent of legal migrants also work in the informal sector. Therefore the informal sector accounts for around 19 percent of the overall workforce.

In our regressions we will only use data on full-time workers. There are about 4,000 such respondents in each year. Respondents also provide information about their occupation, country of origin, year of arrival to Italy, monthly earnings, family status etc. Summary statistics are provided in Table 7 in the Appendix. Table 8 presents the breakdown of the sample by occupations, as well as formal and informal employment for each occupation. It also includes average wages in the formal and informal sector and minimum wage for each occupation.

In order to time the beginning of the recession, we use official macroeconomic data on Lombardy and its eleven provinces.⁵ Figure 2 presents the evolution of unemployment rates in Lombardy's provinces. While there is substantially heterogeneity in levels and dynamics of unemployment across Lombardy's provinces, most provinces have experienced increasing unemployment since 2008.

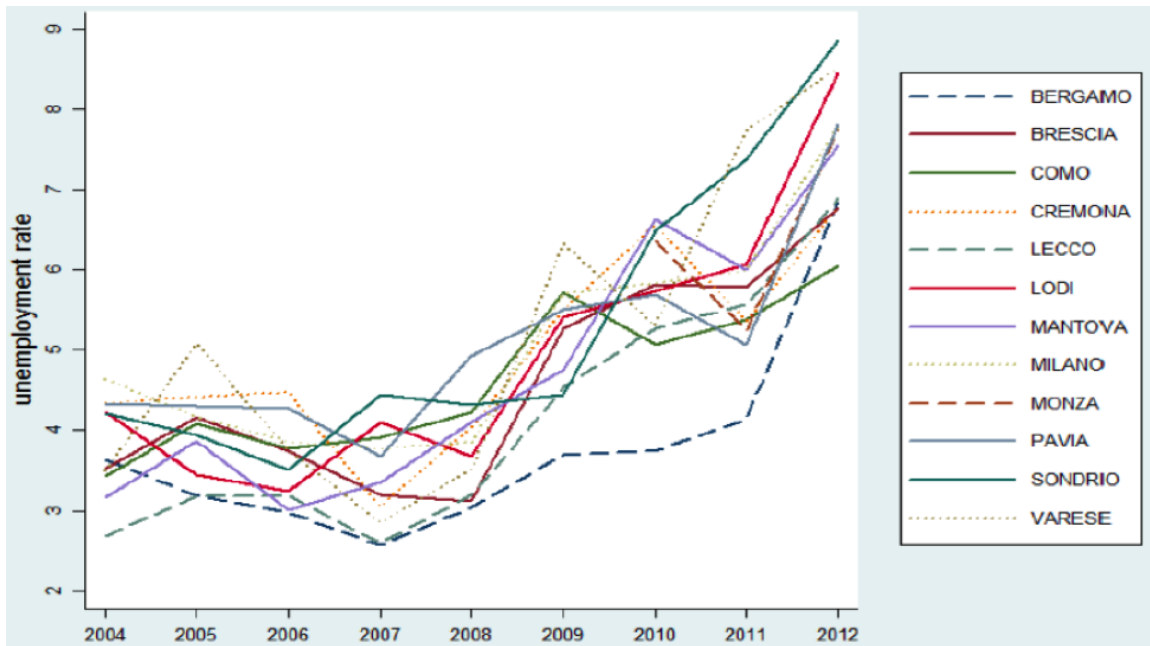
We adopt several definitions of simple/complex occupations. Following Peri and Sparber (2009) and D'Amuri and Peri (2014), we exploit the US Department of Labor's O*NET abilities survey to gain information on the abilities required by each occupation. This database estimates the importance of 52 employee's skills required in each profession. We merge information from the ISMU survey with the O*NET values and select 23 O*NET variables which are believed to give a correct picture of simple/complex jobs (Peri and Sparber (2009) carry out a similar procedure). In particular, we distinguish between two type of skills: manual (or physical) skills represent limb, hand and finger dexterity, as well as body coordination, flexibility and strength; conversely, communication (or language) skills include oral and written comprehension and expression.

Once the 23 variables have been selected (see the Table 9 in the Appendix), we standardize them between 0 and 1 so that they all have them same scale. We then calculate the average of four of them (oral comprehension, written comprehension oral expression, written expression) to create an index of communication skills, and use the rest to calculate an index of manual skills. Clearly, a higher index of communication skills indicates "complex" jobs.

⁴Throughout the paper we use "illegal" and "undocumented" interchangeably. Similarly, we refer to those employed in the formal sector as "regular workers" and those employed in the informal sector as "irregular workers".

⁵The province of Monza e della Brianza was officially created by splitting the north-eastern part from the province of Milan on May 12, 2004, and became fully functional after the provincial elections of June 7, 2009. For consistency with pre-2009 data, we consider the newly-created province of Monza e della Brianza as part of Milan province.

Figure 2: Unemployment by province within Lombardy.



Source: ISTAT

4 Results

4.1 Wages

Our main results are presented in the Table 1. The first column reports the estimates of specification (1). Results are in line with our hypotheses: the wage differential between formal and informal sector is 17 percent before 2008, whilst it rises to 25 percent after the crisis. In Column (2) we assume that the crisis started in 2009 rather than in 2008 and find similar results. Conversely, Column (3) excludes illegal immigrants, showing robustness of our findings to this additional test.

In Column (4) we allow for both jump and the kink in the wage differential between the formal and the informal sector. We find that coefficient at the jump is not significantly different from zero while the coefficient at the kink is significant. In other words, since 2009 the wage differential between formal and informal sector was growing at 4.3 percentage points per year.

In Column (5) we allow for arbitrary evolution of the wage differential and compare the wage differentials in different years to the one in 2008 (which is equal to 18 percentage points). The results are exactly the ones presented in Figure 1. Before 2008, there are no significant changes in the wage differential; formal and

informal wages move in parallel.⁶ After 2008, the situation changes dramatically: the formal and informal wages diverge: in 2009, the wage differential is 5.8 percentage points higher than in 2008, in 2010 — by 9.3 percentage points, in 2011 — by 13 percentage points, and in 2012 — by 17 percentage points. In other words, between 2008 and 2012 informal wages decline so much that the wage differential between formal and informal wages doubles to 35 percentage points.

The other coefficients are intuitive. Holding other things equal, women earn 16 per cent less than men. The effect of age is positive and virtually linear. The coefficient at age squared is statistically significant but is not economically important: each additional year increases earnings by 1.5 percentage points at the age of 18 and by 14 percentage points at the age of 60. Each year spent in Italy raises wages by 1.4 percentage points. Completion of compulsory school increases wages by 4.5 percentage points, higher education — by another 5 percentage points. Such low returns to education are not surprising given that most immigrants are employed in low-skilled and middle-skilled jobs. Married workers earn 2 percentage points higher wages.

As discussed in Section 2, in order to analyze the role of the minimum wage regulations, we estimate the specification (1) separately for occupations where average wage in the formal sector is close to the occupation-specific minimum wage and where it is substantially higher than the minimum wage. For each of the 18 occupations we calculate the average pre-crisis wage in 2007 (in the formal sector only) and divide it by minimum wage. The first two columns of Table 2 present the results of estimating (1) separately for the two subsamples where this ratio is below and above the median. We find that the effect is similar for the two subsamples. This implies that minimum wage is not an important driver of our results.

In the last two columns of Table 2 we add an interaction term between the Crisis dummy (i.e. the dummy for 2008-12 period) and the ratio of average wage to minimum wage. We run this specification separately for the informal sector (the third column of the Table) and the formal sector (the fourth column). We find that after the crisis the informal wages did decline more in occupations where the average wage was closer to the minimum wage. There is no significant difference in the formal sector. Given that the minimum wage can only be binding in the formal sector this result also implies that downward wage stickiness in the formal sector is not driven by the minimum wage. On the other hand, the significant coefficient in the third column (which estimates the relationship for the subsample of the workers employed in the informal sector where the minimum wage cannot bind) suggests that the downward wage flexibility is higher in occupations with higher average wages. This may reflect the bargaining power of the workers who do not agree to wages that fall below subsistence level.

⁶The only exception was year 2004 when the wage differential was 3.6 percentage points greater than in 2008. This difference is statistically significant but not large economically given that 2008 differential was 18 percentage points.

Table 1: Main Results

	Dependent variable: Log wage				
	(1)	(2)	(3)	(4)	(5)
Informal sector	-0.17*** (0.032)	-0.17*** (0.027)	-0.23*** (0.040)	-0.17*** (0.032)	-0.17*** (0.016)
Informal * Crisis	-0.080*** (0.015)	-0.11*** (0.016)	-0.066*** (0.017)	-0.011 (0.024)	
Informal*(Years after 2008)				-0.043*** (0.010)	
Informal*Year2004					-0.036* (0.020)
Informal*Year2005					0.024* (0.012)
Informal*Year2006					0.0090 (0.023)
Informal*Year2007					0.0058 (0.044)
Informal*Year2009					-0.058*** (0.017)
Informal*Year2010					-0.093*** (0.024)
Informal*Year2011					-0.13* (0.072)
Informal*Year2012					-0.17*** (0.019)
Female	-0.17*** (0.0077)	-0.17*** (0.0074)	-0.16*** (0.0085)	-0.17*** (0.0074)	-0.17*** (0.0073)
Age	0.015*** (0.0019)	0.015*** (0.0019)	0.014*** (0.0020)	0.015*** (0.0019)	0.015*** (0.0019)
Age squared	-0.00017*** (0.000025)	-0.00017*** (0.000024)	-0.00016*** (0.000025)	-0.00017*** (0.000024)	-0.00017*** (0.000024)
Years in Italy	0.013*** (0.00095)	0.013*** (0.00096)	0.013*** (0.0010)	0.013*** (0.00097)	0.013*** (0.00095)
Compulsory school	0.041*** (0.012)	0.042*** (0.012)	0.034** (0.012)	0.042*** (0.012)	0.042*** (0.012)
High school	0.060*** (0.011)	0.061*** (0.011)	0.050*** (0.010)	0.061*** (0.011)	0.061*** (0.011)
Tertiary education	0.091*** (0.0090)	0.091*** (0.0087)	0.080*** (0.0079)	0.091*** (0.0087)	0.091*** (0.0087)
Married	0.024*** (0.0060)	0.024*** (0.0060)	0.025*** (0.0059)	0.024*** (0.0060)	0.024*** (0.0059)
Children abroad	-0.00070 (0.0025)	-0.00078 (0.0025)	-0.0017 (0.0026)	-0.00079 (0.0025)	-0.00081 (0.0025)
Children in Italy	0.0043* (0.0020)	0.0043* (0.0020)	0.0041 (0.0025)	0.0043* (0.0020)	0.0042* (0.0020)
Observations	34654	34654	32131	34654	34654
R^2	0.310	0.312	0.310	0.312	0.312

Robust standard errors in parentheses, clustered by province. $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Column (1): is the specification (1). Column (2): crisis is dated at 2009 instead of 2008. Column (3): excludes illegal immigrants. All specifications include year dummies, occupation fixed effects, province fixed effects, and fixed effects of the country of origin.

Table 2: Regressions for subsamples.

	Dependent variable: Log wage			
	Avg.Wage/Min.Wage below median	Avg.Wage/Min.Wage above median	Informal employment	Formal employment
Informal sector	-0.18*** (0.056)	-0.13*** (0.013)		
Informal * Crisis	-0.061** (0.025)	-0.066*** (0.018)		
Crisis*(Avg.Wage/Min.Wage)			-0.15** (0.065)	-0.0063 (0.031)
Female	-0.16*** (0.0097)	-0.18*** (0.027)	-0.20*** (0.037)	-0.16*** (0.020)
Age	0.015*** (0.0047)	0.015*** (0.0026)	0.015*** (0.0035)	0.014*** (0.0017)
Age squared	-0.00017** (0.000066)	-0.00017*** (0.000030)	-0.00018*** (0.000028)	-0.00016*** (0.000019)
Years in Italy	0.011*** (0.0012)	0.013*** (0.0012)	0.013** (0.0057)	0.013*** (0.00097)
Compulsory school	0.020 (0.026)	0.041** (0.016)	0.061** (0.026)	0.025** (0.012)
High school	0.031 (0.024)	0.061*** (0.012)	0.089*** (0.032)	0.036*** (0.012)
Tertiary education	0.060** (0.026)	0.087*** (0.016)	0.15*** (0.037)	0.061*** (0.012)
Married	0.025*** (0.0066)	0.0085 (0.0089)	-0.048** (0.022)	0.030*** (0.010)
Children abroad	-0.0018 (0.0024)	0.0036 (0.0055)	0.022** (0.0092)	-0.0015 (0.0017)
Children in Italy	0.0038 (0.0028)	0.0039** (0.0016)	0.0014** (0.00067)	0.0051** (0.0023)
Observations	17154	15391	4455	28832
R^2	0.238	0.382	0.275	0.274

Robust standard errors in parentheses. $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

All specifications include year dummies, occupation fixed effects, province fixed effects, and fixed effects of the country of origin. Standard errors are clustered by province in the first two regressions and two-way clustered by occupation and crisis dummy (dummy for 2008-2012 period) in the last two regressions.

We also divide occupations into the “simple” and the “complex” ones. As discussed in the Section 3 above, we use two different classifications of Simple vs. Complex occupation based on Peri and Sparber (2009) and O*NET data. In each case, we sort the occupations by the complexity index and define the occupations with the complexity below median as “simple” and the rest as “complex”.⁷

In the Table 3 we present the estimation of specification (1) for simple and complex occupations, respectively. When we use the definition of complexity based on communication/expression skills, we find the coefficient is significant for the simple occupations and is not significant for the complex occupations. For the complexity measures based on the index of manual skills, we find no difference between simple and complex occupations (columns 5 and 6) .

We also check whether there effect is different for formal and informal sector. We find that in the informal sector (column 3) wages decline more during the crisis in simple occupations (lower value of Communication Skills Index) rather than in the complex occupations (higher value of Communication Skills Index). We find no significant differences for the formal sector (column 4) nor when we use the definition of complexity based on the Manual Skills Index (columns 7 and 8).

The results in Table 3 suggest that the impact of the recession on wage differential is present in occupations that are simple in the sense that they do not require communication or expression skills. This is a natural result given that immigrant workers are less likely to substitute natives in communication-intensive occupations — simply due to comparative disadvantage in languages. Our results for the ranking of occupations based on manual skills (second half of the Table) acts as a placebo: there is no difference across occupations require more or less manual skills. It is also natural given that there is no intrinsic difference between migrants and natives in manual skills.

4.2 Robustness checks

Table 4 presents robustness checks. Our many results are obtained for the sample of full-time workers. We now relax this restriction by focusing only on part-time workers (column 1) and both full-time and part-time employment simultaneously (column 2). Results are similar to our benchmark specification. Before 2008 part-time individuals in the informal sector appear to receive 16 percent lower wages than formal workers. The crisis, however, increases this gap up to 28 percent. The wage differential after the recession reaches 26 percent when the sample includes both part-time and full-time workers. In this sample, we also control for

⁷In the case of manual skills, the Simple occupations include No-skilled workers, Skilled workers, Building workers, Farm workers, Craftsmen, and Truck workers. In the case of communication skills, the Simple occupations include No-skilled workers, Farm workers, Cleaners, Food and beverage workers, House helpers (FT), and House helpers (PT).

Table 3: Simple vs. Complex Occupations.

	Dependent variable: Log wage							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Communication Skills				Manual Skills			
	Simple	Complex	Informal	Formal	Simple	Complex	Informal	Formal
Informal	-0.12*** (0.020)	-0.17*** (0.043)			-0.11*** (0.014)	-0.17*** (0.038)		
Informal * Crisis	-0.15*** (0.030)	0.018 (0.043)			-0.075** (0.024)	-0.048** (0.018)		
Comm.Index * Crisis			0.27** (0.13)	0.027 (0.067)				
Manual Index * Crisis							-0.084 (0.18)	0.022 (0.044)
Female	-0.15*** (0.011)	-0.18*** (0.0065)	-0.20*** (0.022)	-0.16*** (0.018)	-0.15*** (0.0095)	-0.16*** (0.0098)	-0.20*** (0.022)	-0.16*** (0.018)
Age, X100	0.25*** (0.041)	0.16** (0.053)	0.16*** (0.026)	0.18*** (0.025)	0.098 (0.082)	0.25*** (0.025)	0.18*** (0.023)	0.18*** (0.025)
Years in Italy	0.011*** (0.0015)	0.013*** (0.0010)	0.013*** (0.0036)	0.013*** (0.00088)	0.015*** (0.00075)	0.0085*** (0.0015)	0.013*** (0.0037)	0.013*** (0.00088)
Married	0.020** (0.0079)	0.034*** (0.0085)	-0.038*** (0.011)	0.038*** (0.0060)	0.065*** (0.0056)	-0.013** (0.0056)	-0.039*** (0.0099)	0.038*** (0.0060)
Children abroad	0.00080 (0.0031)	-0.0032 (0.0038)	0.023*** (0.0049)	-0.0016** (0.00075)	-0.0038 (0.0033)	0.0021 (0.0013)	0.024*** (0.0051)	-0.0015** (0.00075)
Children in Italy	0.0038 (0.0027)	0.0038** (0.0012)	0.0015*** (0.00016)	0.0051 (0.0041)	0.0071 (0.0045)	0.0017* (0.00085)	0.0013*** (0.000098)	0.0051 (0.0041)
Observations	17135	15410	4455	28832	17983	14562	4455	28832
R ²	0.291	0.326	0.273	0.272	0.242	0.274	0.270	0.272

Robust standard errors in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

All specifications include education level dummies, year dummies, occupation fixed effects, province fixed effects, and fixed effects of the country of origin. Standard errors are clustered by province in the specifications (1), (2), (5), (6) and are two-way clustered by occupation and crisis dummy (dummy for 2008-2012 period) in the specifications (3), (4), (7), and (8).

full-time status and find that full-time workers are paid 34 percent more than the part-time workers.

We further distinguish the effect of the crisis by gender (columns 3 and 4) and age (columns 5 and 6). Women in informal employment have an initial wage disadvantage of 18 percent compared to formal female workers, while the wage differential is only 14 percent for men. However, female informal workers turn out to suffer from the crisis to a lesser extent than men, for whom the impact of the recession is as hard. Finally, we compare the results for younger and older workers (below and above the median age of 35 years). The impact of the recession on the wage differential between formal and in formal sector turns out to be similar for younger and older immigrants.

4.3 Labor force participation, employment and unemployment

Our results above describe only one channel of the labor market adjustment to the aggregate demand shocks, namely the decline in wages. To what extent can we calibrate the adjustment through other channels, such as a decrease in labor force participation, increase in unemployment, shift to informal sector and part-time jobs, and labor mobility? Our dataset covers immigrants residing in Italy and therefore does not allow to account for mobility. By definition, immigrants are the most mobile category of workers. A recession may result in their outmigration to more prosperous countries of the Euro area and to the reduced immigration of foreign workers who would otherwise come to Italy. Since our dataset does not cover neither of these categories of workers, we cannot estimate the quantitative importance of this channel. However, we can analyze the changes within the sample covered by our survey.

In Table 5 we present the regressions for labor force participation, unemployment, as well as for formal and full-time employment separately. We report the coefficients at year dummies (where 2008 is the omitted category). First, we find that both before and during the crisis, undocumented immigrants (those without a regular residence permit) are 9 percentage points more likely than documented immigrants to be in the labor force. If in the labor force, the illegal immigrants were as likely to be unemployed as the legal ones before the crisis; since the crisis their unemployment rate was 1.1 percentage points higher. If employed, the undocumented migrants are 80 percent more likely to work in the informal sector (both before and after the crisis).

The year dummies suggest that recession results in reduced labor force participation and increased unemployment. In 2011-12, labor force participation declines by 2-3 percentage points relative to 2008. The unemployment rate—which is constant before the crisis—increases by 0.2 percentages points in 2009, by another 0.3 points in 2010, then it grows by additional 9 percentage points in 2011 and 2 more percentage

Table 4: Robustness Checks.

	(1)	(2)	(3)	(4)	(5)	(6)
	Part-time	Full-time and part-time	Males	Females	Age \leq 35	Age $>$ 35
Informal sector	-0.16*** (0.015)	-0.16*** (0.028)	-0.14*** (0.037)	-0.18*** (0.021)	-0.17*** (0.035)	-0.17*** (0.031)
Informal * Crisis	-0.12*** (0.017)	-0.10*** (0.017)	-0.11*** (0.021)	-0.048* (0.023)	-0.071*** (0.017)	-0.094*** (0.011)
Full time		0.34*** (0.012)				
Female	-0.16*** (0.022)	-0.17*** (0.011)			-0.14*** (0.0074)	-0.20*** (0.011)
Age	0.026** (0.0090)	0.017*** (0.0016)	0.015*** (0.0032)	0.014*** (0.00091)	0.027*** (0.0053)	0.029*** (0.0056)
Age squared	-0.00030** (0.00013)	-0.00019*** (0.000019)	-0.00018*** (0.000045)	-0.00016*** (0.000011)	-0.00040*** (0.000087)	-0.00031*** (0.000058)
Years in Italy	0.0100*** (0.0019)	0.012*** (0.00073)	0.017*** (0.00059)	0.0046*** (0.00094)	0.016*** (0.00094)	0.011*** (0.0018)
Compulsory school	-0.017 (0.022)	0.031** (0.014)	0.045*** (0.014)	0.024 (0.014)	0.030 (0.020)	0.059*** (0.0062)
High school	-0.044* (0.023)	0.042*** (0.013)	0.069*** (0.011)	0.037* (0.017)	0.051** (0.017)	0.077*** (0.0075)
Tertiary education	0.021 (0.029)	0.079*** (0.014)	0.10*** (0.0066)	0.062*** (0.017)	0.082*** (0.019)	0.11*** (0.0086)
Married	-0.065*** (0.016)	0.0043 (0.0049)	0.067*** (0.0094)	-0.045*** (0.0045)	0.034*** (0.010)	-0.0013 (0.0094)
Children abroad	0.013*** (0.0037)	0.000095 (0.0021)	-0.0021 (0.0044)	0.0026 (0.0035)	-0.0014 (0.0070)	0.0012 (0.0030)
Children in Italy	-0.025 (0.015)	0.0031* (0.0016)	0.0070 (0.0041)	-0.00064 (0.0019)	0.0016 (0.0014)	0.0081* (0.0039)
Observations	7575	42229	22725	11929	18543	16111
R^2	0.232	0.411	0.254	0.250	0.293	0.333

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

All specifications include year dummies, occupation fixed effects, province fixed effects, and fixed effects of the country of origin. In columns 3-6, the sample includes only full-time workers.

Table 5: Labor Force Participation, Employment and Unemployment.

Dependent Variable	LFP	Unemployment	Formal	Full-time
Illegal	0.091*** (0.0059)	-0.0019 (0.0017)	-0.80*** (0.0074)	-0.18*** (0.014)
Illegal * Crisis	0.0094 (0.011)	0.011** (0.0036)	0.0076 (0.016)	-0.056* (0.026)
Year2004	0.014 (0.0081)	0.0033 (0.0020)	0.011 (0.015)	-0.0075 (0.0085)
Year2005	0.0013 (0.0057)	0.00086 (0.0017)	0.021** (0.0075)	-0.029** (0.013)
Year2006	-0.0011 (0.0049)	0.0014 (0.0017)	0.0055 (0.011)	-0.022 (0.017)
Year2007	0.0045 (0.0033)	0.0018 (0.0012)	-0.0098 (0.015)	-0.0018 (0.0068)
Year2009	0.0082 (0.0062)	0.0021*** (0.00057)	-0.0088 (0.0078)	-0.0085 (0.012)
Year2010	0.015 (0.013)	0.0055*** (0.0015)	-0.035** (0.011)	-0.036*** (0.0097)
Year2011	-0.026** (0.0087)	0.098*** (0.0071)	-0.045*** (0.011)	-0.079*** (0.011)
Year2012	-0.022** (0.0073)	0.12*** (0.012)	-0.046*** (0.0095)	-0.11*** (0.014)
Female	-0.15*** (0.011)	0.0091*** (0.0015)	-0.026*** (0.0058)	-0.12*** (0.012)
Age	0.027*** (0.0021)	-0.0030*** (0.00051)	0.0090*** (0.0022)	0.011*** (0.0022)
Age squared	-0.00030*** (0.000023)	0.000041*** (0.0000069)	-0.00011*** (0.000028)	-0.00011*** (0.000024)
Years in Italy	-0.0028** (0.00089)	-0.0010*** (0.00019)	0.0090*** (0.0011)	0.0049*** (0.0012)
Compulsory school	-0.0050 (0.0074)	0.0017 (0.0024)	0.042*** (0.0077)	0.031** (0.010)
High school	-0.0074 (0.0086)	-0.0017 (0.0024)	0.052*** (0.0079)	0.038*** (0.0065)
Tertiary education	-0.014 (0.010)	-0.00070 (0.0012)	0.081*** (0.010)	0.026*** (0.0056)
Married	-0.043*** (0.0053)	0.0035 (0.0023)	-0.00094 (0.0053)	-0.010** (0.0039)
Children abroad	0.0024 (0.0014)	-0.00000079 (0.00011)	-0.0028* (0.0015)	0.0030*** (0.00088)
Children in Italy	-0.0028 (0.0016)	-0.00018 (0.00022)	-0.0017** (0.00066)	0.00014 (0.00061)
Observations	61561	52329	45937	45937
R ²	0.590	0.802	0.488	0.130

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Estimates for the linear probability model. LFP: dummy for labor force participation, Unemployment: dummy for unemployment conditional on labor force participation. Formal: dummy for formal employment conditional on employment. Full-time: dummy for full-time employment conditional on employment. All specifications include occupation fixed effects, province fixed effects, and fixed effects of the country of origin.

points in 2012. Also, in 2010-12 there is a shift from formal to informal employment. The share of formal employment declines by 3.5 percentage in 2010 relative to 2008 and by another percentage point in 2011. Finally, there is a shift from full-time to part-time employment: the share of full-time employment declines by 4 percentage points in 2010 relative to 2008, by 4 percentage points more in 2011, and by 3 more percentage points in 2012.

These results suggest that the immigrant labor market undergoes a multi-faceted adjustment. Not only informal wages fall, there is also a decrease in labor force participation, increase in unemployment, reallocation from formal to the informal sector, and reallocation from full-time to part-time jobs.

5 Conclusions

In this paper we study the process of wage adjustment in formal and informal labor markets in Italy. We show that despite the substantial growth of unemployment in 2008-12, the wages in the formal labor market have not adjusted. In the meanwhile, the wages in the unregulated informal labor market have declined substantially. The wage differential between formal and informal market that has been constant in 2004-08 has grown rapidly in 2008-12 from 18 to 35 percentage points. We show that wage adjustment in the informal sector takes place along with decline in labor force participation, growth in unemployment rates, and the shift to informal employment and to part-time jobs.

These results are consistent with the view that regulation is responsible for lack of wage adjustment and increase in unemployment during the recessions. Certainly, we should not overinterpret our results that are based on data on immigrants rather than the general labor force. However, we also find that our results are more pronounced for the individuals in simple occupations. These are the occupations with relatively easy substitutability between immigrants and natives. This allows us to speculate that our findings can be generalized for low-skilled natives as well.

While we do find that in unregulated labor markets wages adjust down during the recession, the 2008-12 period does not provide an exhaustive answer with regard to the speed and nature of this adjustment. Figure 1 and Table 1 show that wages in the informal sector continue to fall throughout the period. As the recession in Italy is still continuing we cannot yet judge whether this continuing decrease in wages is the delayed response to the initial one-off shock or every subsequent decrease is a reaction to the next round of aggregate demand decline. In order to address this important question, we need to collect data on both formal and informal labor market for several year after the economy starts to recover.

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Appendix

Table 6: Irregular workers by legal status and gender

	Legal migrants	Illegal migrants	Male	Female
Regular workers	41,097	114	26,067	15,208
Irregular workers	4,764	4,919	5,335	4,367
Total	45,861	5,033	31,402	19,575

Table 7: Summary statistics.

Variable	Mean	Standard Deviation
Log earnings	6.89	0.43
Labor force participation	0.86	0.35
Employment	0.76	0.43
Unemployment	0.10	0.30
Illegal	0.10	0.30
Female	0.45	0.50
Age	33.9	9.1
Years in Italy	7.06	4.38
Married	0.56	0.50
Children abroad	0.38	2.33
Children in Italy	0.93	4.23
Compulsory school	0.37	0.48
Superior school	0.41	0.49
University	0.14	0.35

Log(earnings) are the net monthly wages as provided directly by the interviewed.

Illegal is a dummy being 1 if the migrant reports having no residence permit.

Data source: ISMU survey data, 2004-2012.

Table 8: Number of workers by occupation and monthly wages.

	Regular workers		Irregular workers		Total		Minimum wage	Average wage	
								regular	irregular
Unskilled workers	8 063	16.3%	523	1.1%	8 586	17.4%	1 277	1 125	1 025
Skilled workers	1 680	3.4%	155	0.3%	1 835	3.7%	1 624	1 345	1 250
Building workers	3 535	7.2%	968	2.0%	4 503	9.1%	1 504	1 343	1 099
Farm workers	2 707	5.5%	898	1.8%	3 605	7.3%	1 263	1 210	966
Cleaners	1 723	3.5%	417	0.8%	2 140	4.3%	1 450	981	800
Warehouse custody workers	1 624	3.3%	258	0.5%	1 882	3.8%	1 362	1 128	902
Clerical workers	910	1.8%	45	0.1%	955	1.9%	1 360	1 125	821
Sales workers	1 332	2.7%	250	0.5%	1 582	3.2%	1 309	1 122	832
Trade workers	1 618	3.3%	897	1.8%	2 515	5.1%		1 526	757
Food and beverage workers	4 322	8.8%	767	1.6%	5 089	10.3%	1 408	1 152	903
Craftsmen	2 495	5.1%	613	1.2%	3 108	6.3%	1 220	1 365	1 053
Truck workers	1 284	2.6%	135	0.3%	1 419	2.9%	1 460	1 494	1 295
House helpers (FT)	1 388	2.8%	666	1.3%	2 054	4.2%	786	898	906
Home-based caregivers	1 969	4.0%	738	1.5%	2 707	5.5%	786	878	809
Baby sitters	474	1.0%	143	0.3%	617	1.2%	786	939	719
Social assistance operators	897	1.8%	27	0.1%	924	1.9%	1 390	1 098	833
Medical and paramedical	878	1.8%	75	0.2%	953	1.9%	1 727	1 439	
Intellectual professions	735	1.5%	131	0.3%	866	1.8%	1 441	1 561	807
Sex workers	2	0.0%	28	0.1%	30	0.1%		3 000	2 500
Sport workers	19	0.0%	3	0.0%	22	0.0%		1 000	
Other workers	557	1.1%	240	0.5%	797	1.6%		1 310	2 200
Total	40 031	81.1%	9 355	18.9%	49 386	100.0%		1 250	938

Wages are in euros per months, calculated only for the full-time workers.

Table 9: Skill types and variables from O*NET

Type of skill	Skill sub-type	O*NET variables
Manual	Limb, hand and finger dexterity	Arm-hand steadiness Manual dexterity Finger dexterity Control precision Multilimb coordination Response orientation Rate control Reaction time Wrist-finger speed Speed of limb movement Extent flexibility
	Body coordination and flexibility	Extent flexibility Dynamic flexibility Gross body coordination Gross body equilibrium Explosive strenght Dynamic strength Trunk strenght Stamina
Communication	Oral	Oral comprehension Oral expression
	Written	Written comprehension Written expression