

Economic Expansion and Increase in Labour Market Formality: A Poaching Approach*

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Contents: 1. Introduction; 2. Related Literature; 3. Theoretical Framework; 4. Descriptive Analysis; 5. Regression Analysis; 6. Conclusion.

This paper investigates the relationship between economic expansion and the degree of formalization for the Brazilian labour market in the recent period. We present a theoretical framework that attempts to explain this relationship through the dynamics of firms hiring strategies. The main predictions are: the share of formal employment rises as the unemployment rate falls, and that the formal-informal wage gap increases, at least at the beginning of the economic expansion. In the empirical part, we use longitudinal microdata from a Brazilian household survey to check whether these two predictions are confirmed. To a large extent our results corroborate both predictions

Neste estudo, investiga-se a relação entre a expansão da economia brasileira e o grau de formalização do seu mercado de trabalho no período recente. Apresentamos um arcabouço teórico que procura explicar essa relação por meio das estratégias de contratação de mão-de-obra por parte das firmas. As principais predições desse arcabouço são: a parcela do emprego formal cresce à medida que a taxa de desemprego cai e o hiato salarial entre empregados formais e informais aumenta, pelo menos na primeira parte do período de expansão da economia. Na parte empírica, dados longitudinais da Pesquisa Mensal de Emprego (PME/IBGE) são utilizados para confirmar ou não essas predições. Os resultados mostram que, em larga medida, elas são confirmadas

Keywords: Informality, Business-cycle, Hirings

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1. INTRODUCTION

Recently, fluctuation in economic activity has stood out in the literature as one of the main forces driving changes in informality rates in the labour market, notably in Less Developed Countries (LDC). The vast empirical evidence in support of this claim (see Perry et al. (2007) and references therein) contrasts with the scarce theoretical efforts proposing specific mechanisms that link labour informality and the business cycle.

The main contribution of the present study is twofold. Firstly, we propose a theoretical framework whose mechanics relies on the dynamics of workers' transitions across unemployment, formal and informal jobs when the economy is expanding. This theoretical framework, which is adapted from the "poaching" version of the job search models recently put forth by Moscarini and Postel-Vinay (2009), offers predictions about the formal/informal composition of employment and the formal/informal wage gap along the expansion of the economy. Secondly, we present an empirical analysis to test whether the predictions made by the proposed theory are consistent with the dynamics of the Brazilian metropolitan labour market between 2003 and 2008.

The proposed theoretical framework focuses on the outflow of workers either from unemployment or from the informal sector into the formal sector. The composition of these flows is influenced by the business cycle in such a way that the share of employment in the formal sector grows during economic expansion.

The proposed framework assumes that unemployed workers tend to have a lower reservation wage than those individuals who hold informal jobs. Therefore, when the unemployment rate is high, formal sector firms can offer a low wage and hire workers who come mainly out of unemployment. As the economy grows, unemployment falls and, little by little, formal sector firms offer higher wages, and begin to poach relatively more workers from informal sector firms, thus increasing the level of labour market formality. To do that, it is assumed that informal sector firms are less productive than formal ones, not being able to adjust wages in a similar fashion. This, in turn, tends to broaden the gap between formal and informal wages along this adjustment period.

In the empirical part of the paper we check whether the business cycle (as measured by the unemployment rate) relates to poaching measures and to the formal/informal wage gap, as predicted by the proposed theory. Specifically, we firstly verify whether a worker newly hired by the formal sector has moved out of unemployment or out of the informal sector, and we check how the worker's previous employment status varies with the aggregate unemployment rate, controlling for his individual observable characteristics.¹ With regard to wages, our aim is to investigate to what extent the gap between the formal and informal sectors varies with unemployment by controlling for workers' observable and unobservable characteristics (as perceived by the analyst).

We consider the recent experience of Brazil a rich "case study" for three reasons. First, the Brazilian economy expanded continuously between 2003 and 2008.² Simultaneously, during this recent period, there was a remarkable increase in labour market formality and a sharp decrease in the unemployment rate.³ Second, the data available for Brazil allow for longitudinal links necessary to track the previous state of the workers hired in formal jobs. Finally, and perhaps most importantly, the data distinguish very well workers employed under a legal contract from those under informal arrangements.

¹In the empirical analysis, we also use an alternative way to identify the groups of informal and unemployed workers. Specifically, we include self-employed workers in the first group and inactive individuals in the second.

²Brazil has a business cycle dating committee (CODACE) in the same spirit as the one created by the NBER. According to CODACE (2009), there was continuous GDP growth between the third quarter of 2003 and the third quarter of 2008 (totaling 21 quarters), representing an accumulated expansion of nearly 30% for the period.

³There was an overall increase of around 8 million formal job openings between 2003 and 2007, which means an average growth of approximately 2 million jobs per year (Corseuil et al., 2009). The share of formality, understood as the share of protected workers (employees with a work card and civil servants) and employers in relation to the total number of employed individuals, increased by 6.8 percentage points between 2001 and 2008 (Corseuil et al., 2010).

The remainder of this paper is organised as follows. Section 2 presents the related literature on informality and business cycles. Section 3 introduces our theoretical framework. The empirical analysis is presented in sections 4 and 5. Section 4 displays some descriptive statistics about the facts we intend to explain, whereas Section 5 shows the estimated parameters that allow testing our hypotheses. The last section concludes.

2. RELATED LITERATURE

The relationship between informality and the business cycle has already been investigated in LDC, including Brazil. In general, the available studies are based on dualism (or segmentation) theories, dating back to Harris and Todaro (1970). Perhaps the best reference regarding these theories is the framework presented by Fields (1975), which somewhat generalises Harris and Todaro's (1970) theory. There are three remarkable assumptions in their theory:

1. Presence of restrictions (albeit partial) on the flow of workers between informal and formal sectors,
2. Exogenous determination (attributed to institutional aspects) of the wage in the formal sector, and
3. The influence of the business cycle is contemplated by demand shocks restricted to the formal sector.

We have at least two reasons to propose an alternative theory. First, as pointed out in Barros et al. (1993), the dualism theory is not compatible with the fact that the wage gap between the formal and informal sectors is procyclical, a phenomenon that has been previously observed in Brazil in other periods. Second, the imposition of restrictions on the flow of workers between the informal and formal sectors was empirically contested by Bosch et al. (2007), among others.

Therefore, in our model, we seek to relax the three hypotheses above, which are at the core of the dualism theory.

Recently, other authors have also proposed alternative models to the received theory of segmentation in order to assess the relationship between informality and the business cycle. Boeri and Garibaldi (2007) and Bosch and Esteban-Pretel (2009) suggest theoretical frameworks that relax the latter two hypotheses and predict how the level of (in)formality of workers relates to the business cycle. Both are based on extensions of the matching model proposed by Mortensen and Pissarides (1994), to which an informal sector is added. The papers show predictions that are compatible with Brazilian labour market facts. However, the assumption to restrict the flow of workers between formal and informal sectors is present in both papers, being therefore a limitation.⁴

Empirically, both studies above use data from the Brazilian household survey that is also the source of information for our empirical analysis. Boeri and Garibaldi (2007) describe a positive correlation between unemployment and informality. In addition to corroborating this result, Bosch and Esteban-Pretel (2009) also describe a relationship between the business cycle and the hiring and separation rates in the formal and informal sectors, separately, as well as a relationship between the business cycle and the flow of workers across these two sectors.

It should be pointed out that other factors, specific to the Brazilian experience, have been indicated as possible explanations for the recent decrease in informality observed in Brazil. Among these factors,

⁴Note that these papers consider a direct flow between the formal and informal sectors, by looking at job positions. In other words, even though worker flow between the informal and the formal sectors (without going through unemployment) is not allowed, it is assumed that an informal job position can change into a formal employment relationship, allowing the worker in this position to change sectors.



we highlight: credit expansion for firms (Catao et al., 2009), reduction in the tax burden for small- and medium-sized firms (Corseuil and Moura, 2010), and enforcement of labour laws (Almeida and Carneiro, 2007).

3. THEORETICAL FRAMEWORK

Our theoretical framework consists of an adaptation of the poaching model developed by Moscarini and Postel-Vinay (2009), which is an extension of the job search model proposed by Burdett and Mortensen (1998). Initially, we show how the model originally proposed by Moscarini and Postel-Vinay works, as well as some predictions of their model. After that, based on some assumptions, we apply the model and its predictions to a labour market with formal and informal jobs.

Suppose that all workers are identical and that firms differ in terms of productivity. Information does not flow perfectly in the labour market, causing firms and workers to engage in a search for the other part. It is not only unemployed individuals who search for a job, but employed ones can search for a better job. As a result, at any time, any worker, unemployed or not, has a fixed probability to get a job offer. The decision to take or not the offer depends on the comparison between the current value of the proposed wage and the worker's reservation wage. The reservation wage is the value that equates the current value of the expected utility flow in the job position the worker is occupying. So, the reservation wage of unemployed workers is expected to be the lowest of all.

On the other end of the labour market, firms produce a homogeneous product using some technology with constant returns to scale. The context of imperfect information generates a monopsony power for firms in the labour market that allows them to offer lower wages than their employees' level of productivity. Therefore, it will always be advantageous for firms to offer vacancies, and firm size will be limited by the difficulty they will have finding workers to fill these positions.

Firms choose wage trajectories to be offered to each and every worker regardless of his level of experience and of his status in the labour market.⁵ This choice should maximize the current value of the expected profit flow, in compliance with the restriction imposed by a federally mandated minimum wage, as well as with the dynamics of the state variables of this maximization problem.⁶ Moscarini and Postel-Vinay (2009) show that the wage trajectory to be offered depends on the firm's productivity; consequently, the wage trajectories offered by more productive firms tend to be more advantageous for workers than those offered by less productive firms.⁷ Also, more productive firms employ more workers than less productive ones. Thus, workers' flow occurs in one direction only: from a less productive firm to a more productive one, that is to say, from a smaller to a bigger firm.

The arguments of Moscarini and Postel-Vinay (2009) can be summarised as follows. Consider an economy that is just finding its way out of a recession and is about to go through a continuous period of economic expansion, with a reduction in unemployment. To begin with, firms prefer to hire workers who are unemployed, given the bountiful supply of workers with such a status, and also considering that it is possible to lure them with relatively low wages. As time moves forward, unemployment tends to decrease and it gets harder to hire workers from this source. Initially, more unemployed individuals find a job in small firms as they are more numerous than their bigger counterparts. Therefore, the total of employees in relatively small firms increases in the first moments of the recovery. However employees in relatively small firms continue to seek jobs in bigger firms. Thus, there are greater chances of a big firm hiring an employee from a small firm as unemployment falls. This flow of employees from

⁵This is perhaps the main contribution of these authors to the model proposed by Burdett and Mortensen (1998), who consider the choice of a fixed value for the wage offered by firms.

⁶The state variables of this problem are the number of employees in the firm and the employment value attributed by the worker. The detailed formulation of this problem is provided in equations (1) through (4) in Moscarini and Postel-Vinay (2009).

⁷The authors only assess the equilibriums that maintain the firm's productivity ranking over time. This means that if, at any time, a firm offers a more advantageous trajectory for the worker than another firm, this must be valid for all time periods.

small firms into big firms increases the share of workers in big firms in total employment during the remaining moments of economic revival. This is the major prediction explored in this paper.

Another noteworthy prediction refers to the behavior of the wage gap between bigger and smaller firms. With economic expansion, it is optimal for firms to increase both the employment and the wage offers to workers. However, larger firms can increase the wage offers much more than can smaller firms (owing to the productivity differential). So, at first, the wage gap between bigger and smaller firms tends to increase as unemployment decreases. However, this variation in the wage gap can reverse at some point, decreasing as the economy draws near a steady state.⁸

We explore these predictions using an adaptation that takes into consideration the coexistence of formal and informal sectors in the economy. Note that the highest levels of employment and wage associated with big firms result from the fact that these firms are more productive. This way, all the description outlined for the evolution of employment between big and small firms can be reformulated for more and less productive firms, respectively. If we consider that formal sector firms are more productive than those of the informal sector, the theoretical framework can be adapted straightforwardly. In fact this consideration can be grounded by theoretical works modeling firms' sector choice. Since Rauch (1991) seminal paper it is a standard result that firms above (below) a threshold value for productivity chooses the (in)formal sector. See for instance De Paula and Scheinkman (2011) for a more recent contribution providing the same result. Therefore, we propose to classify firms into formal and informal instead of into big and small.⁹

According to this view, we can observe the increase in the share of formal employment during economic expansion, especially after its initial stage. This growth would be based on an outflow of workers from informal to formal employment. We should also expect the wage gap between the formal and informal sectors to increase during the period of economic expansion. In the remainder of this paper, we check whether the data for the Brazilian metropolitan labour market for the 2003-2008 period confirm these predictions.

4. DESCRIPTIVE ANALYSIS

We use data from several waves of a monthly household survey that covers the six main Brazilian metropolitan regions.¹⁰ This survey, known as Pesquisa Mensal do Emprego (PME) and conducted by the Instituto Brasileiro de Geografia e Estatística (IBGE), aims to provide detailed information on participation in the labour market and employment conditions of each respondent, including whether an employment relation complies with the labour legislation or not.¹¹

PME provides longitudinal links since the sample is designed as a rotating panel. A household in the PME sample is typically surveyed for four months in a row, is dropped from the sample for the subsequent eight months, and is reintroduced into the sample one year after the first interview for another set of interviews for four months in a row. Although individuals do not get an identification code, it is possible to identify the household. Therefore, we assume that we can identify individuals when information such as birth date and sex appears with the same values in two consecutive interviews in the same household.¹²

⁸A proof of this result is available from the authors upon request.

⁹Implicitly, we assume that firms offer only one type of job position, that is, either all employees have a formal employment relationship or all have an informal status.

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¹¹Those are: São Paulo, Rio de Janeiro, Belo Horizonte, Porto Alegre, Salvador, and Recife.

¹²In Brazil, workers have a card in which firms are supposed to sign attesting the conditions of the contract. This card is used by the Ministry of Labour to inspect the rights of the workers. So, when the employer signs the card, it means that he is complying



Our aim in this section is to conduct a preliminary analysis of what happens when the unemployment rate falls, therefore we use all the waves of PME comprised in the period from 2003 to 2008. For this period, we want to check whether:

1. The share of formal workers in the private sector tends to increase;
2. The flow of workers from informal into formal jobs tends to increase relative to the flow of unemployed individuals into formal employment.

As the focus of the theory is on formal sector hirings, in this study, we do not assess how the workers' flows from the formal sector into unemployment and into the informal sector react to the business cycle.

Figure 1 provides evidence about item *i*), showing the evolution of the unemployment rate and of the share of formal jobs in the private sector (henceforth this indicator will be referred to as formality rate). The raw data seem to be negatively correlated, as predicted by the theory, i.e., there would be an increase in formality in periods of low unemployment. This phenomenon is more evident in the last months of 2004, as shown in the figure. In order to obtain a more accurate indicator of this association, we calculated the correlation coefficient (r) of these series. Not only does the result confirm our suspicion of a negative correlation, but it also indicates a significant magnitude of -0.76 .

To analyze claim *ii*), we use an indicator that captures to what extent formal sector firms hire relatively more or less workers from informal sector vis-à-vis the amount of unemployed workers hired. Thus, we compute the following indicator, which we will call *poaching probability*:

$$Z_t = \text{flow}(IJ_{t-1} \rightarrow FJ_t) / [\text{flow}(IJ_{t-1} \rightarrow FJ_t) + \text{flow}(U_{t-1} \rightarrow FJ_t)]$$

where the numerator represents the number of workers in formal jobs (FJ) in month t , hired from informal jobs (IJ) in the previous month ($t-1$). The denominator includes the flow out of unemployment (U).¹³

The thin lines in Figure 2 show the evolution of this indicator and that of the unemployment rate between 2003 and 2008. In this case, it is much harder to observe a clear correlation between these variables due, in part, to the high volatility of our poaching indicator. In fact, the correlation coefficient between these series is 0.01, showing that, at least in the whole 2003-2008 period, there does not seem to be an association between the unemployment rate and the poaching probability.

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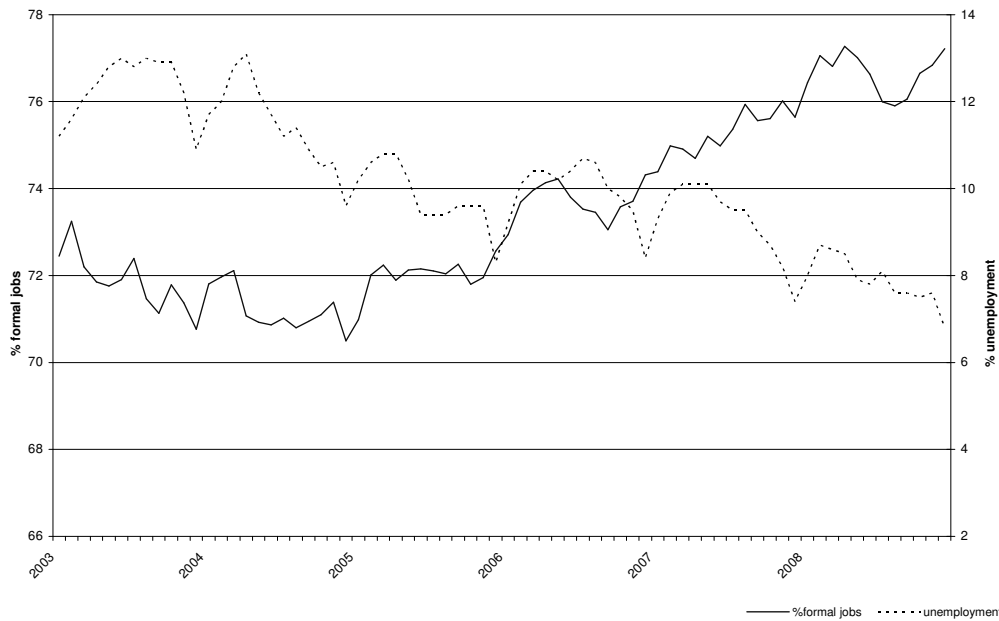
However, the lack of correlation in the whole period may be caused by correlations switching signs in different subperiods, which cancel each other out when the whole period is considered. In order to clarify whether movements are uncorrelated at no time between 2003 and 2008, we "smoothed" both series by calculating their respective centered 12-month moving averages, shown by thicker lines in Figure 2.

These smoothed series unveil some information that was not evident in the original series. Specifically, it is possible to observe that the series have a clear negative correlation until the end of 2006 and

with the labour legislation. PME provides the information on whether the worker has his card signed by his current employer or not.

¹³Note that we left out observations of non-adjacent interviews, i.e. those between the fourth and fifth interviews of the household.

Figure 1: Evolution of the share of formal employment and of the unemployment rate (in %)



that they have a positive correlation from 2007 to mid-2008. As a matter of fact, the correlation coefficient of the raw data (0.01) for the whole period, as pointed out, decreases to -0.41 when we consider the 2003-2006 subperiod. Thus, we can say that the poaching probability is negatively correlated with unemployment in most of the analyzed period, as predicted by the theoretical framework described in Section 2.

5. REGRESSION ANALYSIS

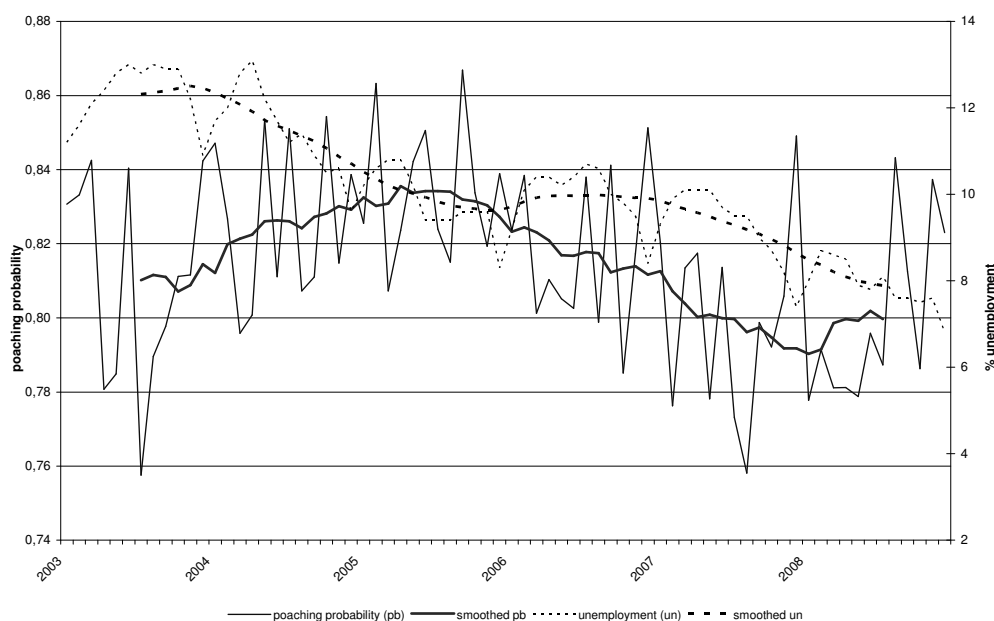
5.1. Analysis of Transition Probabilities

It is important to underscore that the correlations described in the previous section can result from the use of mechanisms other than those proposed by the theory. For instance, the composition of the group of informal workers and of the group of unemployed workers in relation to productive attributes (schooling, experience) or subject to discrimination (race, gender) can vary to such an extent that the former group becomes more attractive to formal sector firms than the latter. In other words, if informal workers changed their productive traits over time relative to unemployed individuals, it is likely that formal sector firms will hire proportionally more workers from the former group simply because they need a labour force with the productive characteristics more abundantly available among informal workers.

The aim of this section is to test whether the qualitative result of the previous section is still valid when we add the possible influences of individual characteristics in this process. Our basic sample is restricted to workers who have just been hired for a formal sector job, who were either unemployed or worked informally, between January 2004 and December 2008.



Figure 2: Evolution of the poaching probability and of the unemployment rate (in %)



We used alternative specifications of regression models to test the hypothesis that matters to us. The probability to be estimated can be written as:

$$P(y_{it} = 1|X_{it}, u_{rt}) = \Lambda(X'_{it} \cdot \beta + u_{rt} \cdot \delta) \tag{1}$$

where $\Lambda(\cdot)$ denotes the logistic function and y_{it} is equal to 1 if individual i just hired for a formal job in month t was working informally in month $(t - 1)$, and equal to 0 if he was unemployed. The variable u_{rt} denotes the unemployment rate in the metropolitan region r and X_{it} is a control vector we will specify in different ways. The first specification contains only dummy variables for the following individual characteristics: schooling, sex, age, and race. In the second one, we introduce dummy variables to capture the quarterly seasonality and in the third one we include year dummies. The last specification adds a variable to capture fluctuations in reservation wages. To achieve that, we use the per capita labour earnings of the household excluding the earnings of worker i . All specifications contain dummies for metropolitan region.

Parameter δ in equation (1) provides the most valuable information for our study. It informs us how unemployment in the metropolitan region in which a formal worker lives affects the probability that this worker was previously in an informal job.

Table 1 shows the estimated values for δ and the respective coefficients for the control variables used in the model's specifications. As can be observed, the estimate of our parameter of interest is positive for the first two specifications, but it is negative for the third and fourth ones, when we introduce the year dummies and the variable that controls for reservation wage fluctuations, respectively. Therefore,

the assumption that formal sector firms tend to hire relatively more informal workers than unemployed ones when the unemployment rate decreases is only confirmed for the latter two specifications.¹⁴

Our descriptive analysis had indicated that the correlation between the unemployment rate and the poaching probability was not homogenous throughout the analyzed period. Figure 3 shows the estimated value for δ when we consider subsamples of two years with one quarter in between. That is, the first point in each line of Figure 3 correspond to values estimated for the January 2004-December 2005 subsample, the second one refers to the April 2004-March 2006 subsample, and so on and so forth, up to the last point, which has to do with the January 2007-December 2008 subsample. The lines in the figure correspond to the previously outlined specifications.

Figure 3 demonstrates that the estimates of δ have a negative sign for virtually all subperiods and specifications when we consider two-year subperiods.¹⁵ This includes the estimates based on the first two specifications, which have a positive sign when the whole period was used in the estimation. Therefore, Figure 3 provides evidence that the hypothesis being tested is confirmed, at least for shorter time periods.

The exercises discussed hitherto leave out some of the worker flows into formal employment, in particular workers who were self-employed or who were inactive. These workers can be added to our analysis if we use broader concepts of informality and of unemployment. Self-employed workers can be included in the group of informal workers, thus constituting a broader group of informally hired workers; on the other hand, inactive workers can be included in the group of those hired out of unemployment, thus constituting a broader group of unemployed workers. Note that, if the hiring dynamics for formal positions does not make a distinction between informal (i.e. employee without a work card) and self-employed workers or between unemployed and inactive individuals, then these extended groups are more suitable for our analysis than the previous groups.

Using these extended groups, we repeat the exercises described in Table 1 and in Figure 3, redefining y_{it} , which is now equal to 1 if individual i just hired for a formal job in month t had an informal job or was a self-employed worker in month $(t - 1)$, and 0 if he was unemployed or inactive. The results of these new exercises are shown in Table 2 and in Figure 4.

As shown in Table 2 and in Figure 4, the estimates of the parameter of interest are negative for all specifications of the model and subperiods analyzed.¹⁶ Therefore, the hypothesis that the flow of informal workers into formal employment increases as the unemployment rate decreases is consistently confirmed when extended groups of informal and unemployed workers are used.

The exercises we have just analyzed do not include workers who transit across formal jobs. However, the inclusion of this group can be important for our analysis because some of the formal sector firms hire workers from other formal sector firms. Thus, we redefine y_{it} , which now has three possible values: 1 if individual i just hired for a formal job in month t had another formal job in month $(t - 1)$, 2 if he had an informal job or a self-employed position, and 3 if he was unemployed or inactive.

Given that we have three categories in this exercise, we use the multinomial logit model. The results of this exercise are shown in Tables 3A and 3B, as the multinomial logit model estimates the effect of

¹⁴The unemployment rate in the same month in which the worker takes the formal sector job is likely to be too close to this transition to capture the effect of interest. Thus, we re-estimated the model using unemployment rate

(i) lagged one month,

(ii) lagged three months and

(iii) the mean unemployment rate of the quarter in which the transition took place.

The results, which can be requested from the authors, are qualitatively similar to those shown in Table 1.

¹⁵Except for the estimate of specification 2 for the July 2006-June 2008 period, all the remaining estimates of are statistically significant at 1%.

¹⁶All the remaining estimates of δ in Figure 4 are statistically significant at 1%.

Table 1: Logit Model Estimates – Workers Either in Informal Jobs or Unemployed in Month $t - 1$ Hired for a Formal Job in Month t

Covariates	Specifications							
	1		2		3		4	
Unemployment Rate	0,0051	***	0,0145	***	-0,0542	***	-0,0618	***
	(0,0004)		(0,0004)		(0,0008)		(0,0009)	
Intercept	2,3396	***	2,2794	***	2,9949	***	3,1294	***
	(0,0093)		(0,0094)		(0,0115)		(0,0140)	
Schooling								
1 to 3 years	-0,0905	***	-0,0904	***	-0,0958	***	-0,1688	***
	(0,0075)		(0,0075)		(0,0075)		(0,0100)	
4 to 7 years	-0,0597	***	-0,0603	***	-0,0621	***	-0,3630	***
	(0,0066)		(0,0066)		(0,0066)		(0,0088)	
8 to 10 years	-0,3801		-0,3806		-0,3769		-0,8411	
	(0,0066)		(0,0066)		(0,0066)		(0,0087)	
11 or more	-0,4277		-0,4269		-0,4195		-1,1996	
	(0,0065)		(0,0065)		(0,0065)		(0,0087)	
Age								
18 to 24 years	-0,5154	***	-0,5168	***	-0,5259	***	-0,4533	***
	(0,0051)		(0,0051)		(0,0051)		(0,0057)	
25 to 49 years	-1,2298	***	-1,2307	***	-1,2391	***	-1,0183	***
	(0,0033)		(0,0033)		(0,0033)		(0,0038)	
50 or older	-0,9843	***	-0,9846	***	-0,9912	***	-0,6855	***
	(0,0032)		(0,0032)		(0,0032)		(0,0038)	
White	0,3266	***	0,3253	***	0,3227	***	0,1148	***
	(0,0013)		(0,0013)		(0,0013)		(0,0015)	
Male	0,0905	***	0,0902	***	0,0906	***	0,1497	***
	(0,0013)		(0,0013)		(0,0013)		(0,0015)	
Per capita income	-		-		-		0,0015	***
	-		-		-		(0,0061)	
Metropolitan Region Dummies	Yes		Yes		Yes		Yes	
Quarterly Dummies	No		Yes		Yes		Yes	
Year Dummies	No		No		Yes		Yes	

Source: PME Microdata (IBGE from January 2004 to December 2008)

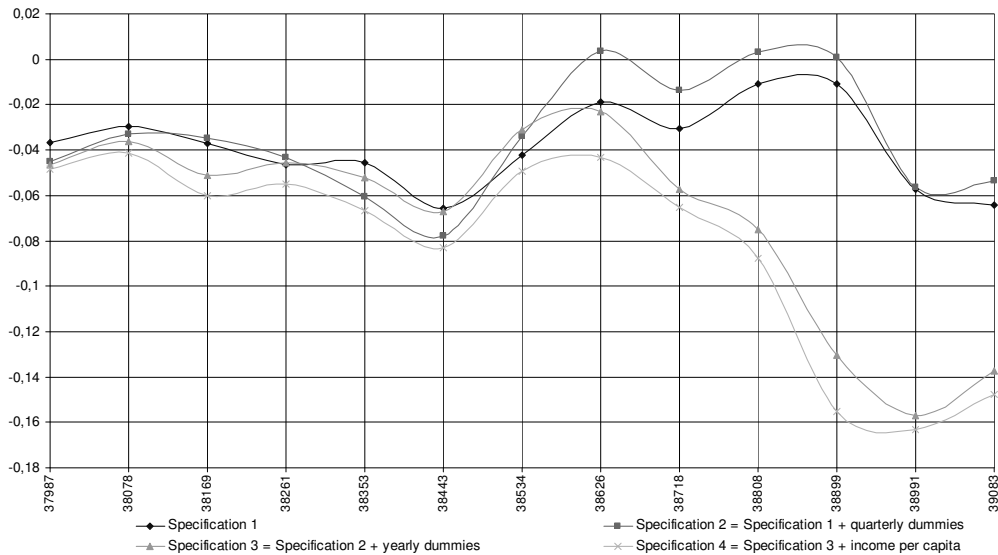
Notes:

(1) The dependent variable assumes value 1 if worker transition was from the informal sector (without a work card or self-employed) and 0 if from unemployment or inactivity.

(2) Standard errors in brackets. Significance levels: (*) 10%, (**) 5% and (***) 1

(3) Omitted categories: less than 1 year of schooling and 15 to 17 years old.

Figure 3: Logit Model Estimates with a Two-Year Moving Window – Informally hired and Unemployed Workers in Month $t - 1$ who Took a Formal Sector Job in Month t



each variable relative to a base category. In our case, we used the unemployed or inactive workers as the base group. Therefore, in Table 3A we report the effect of the respective variable, of each specification, using the odds ratio for “those hired from formal jobs versus those hired from unemployment or inactivity”; while in Table 3B, we report the odds ratio for “those hired from informal jobs versus those hired from unemployment or inactivity”.

So, we consider Table 3B as the most important for our purpose and is more comparable with the results of previous exercises. The results in this table show coefficients that are always negative for the unemployment rate, indicating that a decrease in unemployment tends to increase the probability of a worker being hired from an informal job rather than from an unemployed status. This result then corroborates our hypothesis.¹⁷

5.2. Analysis of Wage Gap between Formal and Informal Employment

This subsection tests the prediction of our theoretical framework that the wage gap between the formal and informal sectors increases at least at the beginning of economic expansion. Therefore, let us consider the following regression model specified for panel data:

$$\ln(w_{it}) = X'_{it} \cdot \beta + u_{rt} \cdot \gamma + F_{it} \cdot \delta + (F_{it} \cdot u_{rt}) \cdot \lambda + \theta_i + v_{it} \quad (2)$$

¹⁷Even though it is not within the scope of our study, it is interesting to note that the coefficient that measures the relationship between the unemployment rate and the transition from a formal sector job to another formal sector job is negative in the most comprehensive specifications (3 and 4). This might indicate a relative increase in turnover *within* the formal sector during economic expansion.

Table 2: Logit Model Estimates – Informally Hired or Self-Employed and Unemployed or Inactive Workers in Month $t - 1$ who Were Hired for a Formal Sector Job in Month t

Covariates	Specifications							
	1		2		3		4	
Unemployment Rate	-0,0128	***	-0,0056	***	-0,0627	***	-0,0654	***
	(0,0003)		(0,0004)		(0,0007)		(0,0008)	
Intercept	1,2509	***	1,2024	***	1,7919	***	1,4530	***
	(0,0070)		(0,0070)		(0,0092)		(0,0101)	
Schooling								
1 to 3 years	0,1900	***	0,1909	***	0,1904	***	0,2265	***
	(0,0050)		(0,0050)		(0,0050)		(0,0054)	
4 to 7 years	0,2740	***	0,2745	***	0,2749	***	0,2219	***
	(0,0043)		(0,0043)		(0,0043)		(0,0046)	
8 to 10 years	0,2297	***	0,2302	***	0,2330	***	0,1297	***
	(0,0043)		(0,0043)		(0,0043)		(0,0046)	
11 or more	0,4212	***	0,4226	***	0,4290	***	0,0977	***
	(0,0042)		(0,0042)		(0,0042)		(0,0045)	
Age								
18 to 24 years	0,0459	***	0,0440	***	0,0389	***	0,2572	***
	(0,0045)		(0,0045)		(0,0045)		(0,0048)	
25 to 49 years	-0,7778	***	-0,7787	***	-0,7835	***	-0,4690	***
	(0,0023)		(0,0023)		(0,0023)		(0,0025)	
50 or older	-0,5236	***	-0,5239	***	-0,5272	***	-0,2252	***
	(0,0021)		(0,0021)		(0,0021)		(0,0023)	
White	0,3746	***	0,3736	***	0,3720	***	0,2173	***
	(0,0012)		(0,0012)		(0,0012)		(0,0013)	
Male	0,5966	***	0,5965	***	0,5973	***	0,7439	***
	(0,0011)		(0,0011)		(0,0011)		(0,0012)	
Per capita income	-		-		-		0,0012	***
	-		-		-		(0,0052)	
Metropolitan Region Dummies	Yes		Yes		Yes		Yes	
Quarterly Dummies	No		Yes		Yes		Yes	
Year Dummies	No		No		Yes		Yes	

Source: PME Microdata (IBGE from January 2004 to December 2008)

Notes:

(1) The dependent variable assumes value 1 if worker transition was from the informal sector (without a work card or self-employed) and 0 if from unemployment or inactivity.

(2) Standard errors in brackets. Significance levels: (*) 10%, (**) 5% and (***) 1

(3) Omitted categories: less than 1 year of schooling and 15 to 17 years old.

Table 3A: Multinomial Logit Model with self-employed and informally hired workers versus unemployed and inactive workers

Covariates	Specifications							
	1		2		3		4	
Unemployment Rate	0,0130	***	0,0225	***	-0,0169	***	-0,0197	***
	(0,0005)		(0,0005)		(0,0009)		(0,0010)	
Intercept	-0,6388	***	-0,7221	***	-0,5410	***	-0,6034	***
	(0,0093)		(0,0095)		(0,0111)		(0,0116)	
Schooling								
1 to 3 years	-0,0335	***	-0,0342	***	-0,0381	***	-0,0588	***
	(0,0041)		(0,0041)		(0,0041)		(0,0042)	
4 to 7 years	-0,1736	***	-0,1741	***	-0,1780	***	-0,1568	***
	(0,0035)		(0,0035)		(0,0035)		(0,0036)	
8 to 10 years	-0,2076	***	-0,2080	***	-0,2130	***	-0,1738	***
	(0,0035)		(0,0035)		(0,0035)		(0,0036)	
11 or more	-0,4008	***	-0,4020	***	-0,4089	***	-0,2844	***
	(0,0034)		(0,0034)		(0,0034)		(0,0035)	
Age								
18 to 24 years	-0,3363	***	-0,3354	***	-0,3327	***	-0,4201	***
	(0,0033)		(0,0033)		(0,0033)		(0,0034)	
25 to 49 years	-0,2004	***	-0,1999	***	-0,1980	***	-0,3214	***
	(0,0018)		(0,0018)		(0,0018)		(0,0019)	
50 or older	-0,2142	***	-0,2142	***	-0,4089	***	-0,3454	***
	(0,0017)		(0,0017)		(0,0034)		(0,0018)	
White	-0,1198	***	-0,1191	***	-0,1186	***	-0,0570	***
	(0,0008)		(0,0008)		(0,0008)		(0,0009)	
Male	-0,2634	***	-0,2634	***	-0,2639	***	-0,3346	***
	(0,0008)		(0,0008)		(0,0008)		(0,0008)	
Per capita income	-		-		-		0,0010	***
	-		-		-		(0,0000)	
Metropolitan Region Dummies	Yes		Yes		Yes		Yes	
Quarterly Dummies	No		Yes		Yes		Yes	
Year Dummies	No		No		Yes		Yes	

Source: PME Microdata (IBGE from January 2004 to December 2008)

Notes:

(1) The dependent variable assumes value 1 if worker transition was from the informal sector (without a work card or self-employed) and 0 if from unemployment or inactivity.

(2) Standard errors in brackets. Significance levels: (*) 10%, (**) 5% and (***) 1

(3) Omitted categories: less than 1 year of schooling and 15 to 17 years old.



Table 3B: Multinomial Logit Model with self-employed and informally hired workers versus unemployed and inactive workers

Covariates	Specifications							
	1		2		3		4	
Unemployment Rate	-0,0140	***	-0,0071	***	-0,0630	***	-0,0649	***
	(0,0003)		(0,0004)		(0,0007)		(0,0007)	
Intercept	1,4137	***	1,3494	***	1,7581	***	1,6408	***
	(0,0063)		(0,0064)		(0,0077)		(0,0084)	
Schooling								
1 to 3 years	-0,0961	***	-0,0968	***	-0,0966	***	-0,1152	***
	(0,0025)		(0,0025)		(0,0025)		(0,0027)	
4 to 7 years	-0,1381	***	-0,1387	***	-0,1391	***	-0,1568	***
	(0,0021)		(0,0021)		(0,0021)		(0,0036)	
8 to 10 years	-0,1172	***	-0,1178	***	-0,1193	***	-0,1738	***
	(0,0021)		(0,0021)		(0,0021)		(0,0036)	
11 or more	-0,2146	***	-0,2156	***	-0,2190	***	-0,2844	***
	(0,0021)		(0,0021)		(0,0021)		(0,0035)	
Age								
18 to 24 years	-0,0271	***	-0,0261	***	-0,0232	***	-0,1317	***
	(0,0023)		(0,0023)		(0,0023)		(0,0024)	
25 to 49 years	0,3899	***	0,3903	***	0,3925	***	0,2372	***
	(0,0011)		(0,0011)		(0,0011)		(0,0012)	
50 or older	0,2629	***	0,2629	***	-0,2190	***	0,1145	***
	(0,0011)		(0,0011)		(0,0021)		(0,0012)	
White	-0,1896		-0,1891	**	-0,1882		-0,1099	***
	(0,0006)		(0,0006)		(0,0006)		(0,0007)	
Male	-0,2993	***	-0,2993	***	-0,2995	***	-0,3728	***
	(0,0006)		(0,0006)		(0,0006)		(0,0006)	
Per capita income	-		-		-		0,0012	***
	-		-		-		(0,0000)	
Metropolitan Region Dummies	Yes		Yes		Yes		Yes	
Quarterly Dummies	No		Yes		Yes		Yes	
Year Dummies	No		No		Yes		Yes	

Source: PME Microdata (IBGE from January 2004 to December 2008)

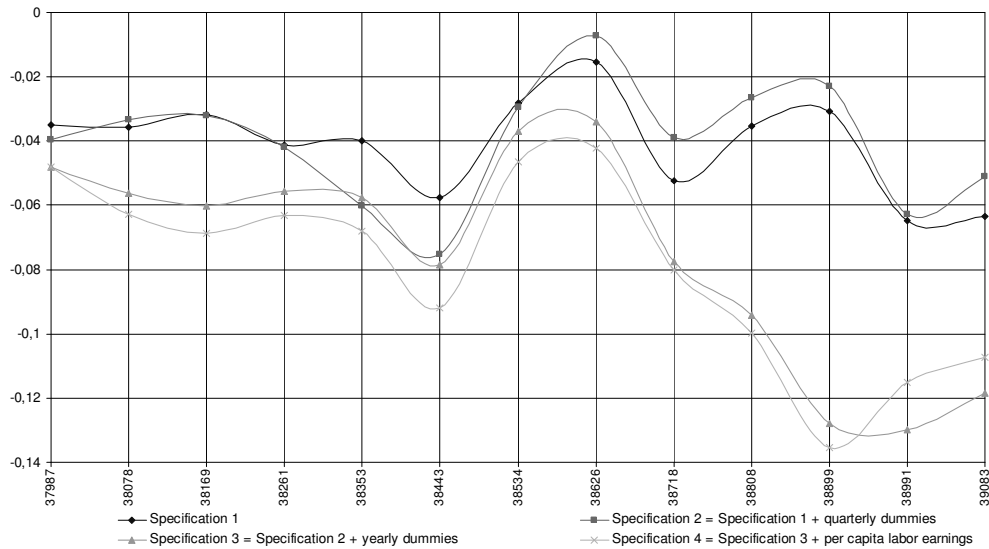
Notes:

(1) The dependent variable assumes value 1 if worker transition was from the informal sector (without a work card or self-employed) and 0 if from unemployment or inactivity.

(2) Standard errors in brackets. Significance levels: (*) 10%, (**) 5% and (***) 1

(3) Omitted categories: less than 1 year of schooling and 15 to 17 years old.

Figure 4: Logit Model Estimates with a Two-Year Moving Window – Informally hired and Self-Employed Workers and Unemployed and Inactive Workers in Month $t - 1$ who Took a Formal Sector Job in Month t



where w_{it} is the actual wage of worker i in month t , X_{it} is a vector of time-varying and time-invariant characteristics of this worker, u_{rt} is the unemployment rate of metropolitan region r in which worker i lives and F_{it} is a dummy variable that assumes value 1 if the worker has a formal job in month t , and 0 otherwise. The term θ_i captures the time-invariant characteristics of worker i that are not observed by the analyst and potentially affect his wage (e.g. innate ability). We admit that θ_i may be correlated with the model's covariates. The term v_{it} represents a random disturbance with zero mean, possibly heteroskedastic, but uncorrelated with the other covariates.

To estimate this model, we used the first-difference method, which is widely employed in the panel data literature:¹⁸

$$\Delta \ln(w_{it}) = \Delta X'_{it} \cdot \beta + \Delta u_{rt} \cdot \gamma + \Delta F_{it} \cdot \delta + [\Delta(F_{it} \cdot u_{rt})] \cdot \lambda + \Delta v_{it}, \quad (3)$$

where Δ denotes the time difference between month t and month $(t - 1)$. Note that, in the transition of worker i from an informal job to a formal one, ΔF_{it} is equal to 1. As before, we test the prediction of interest in two complementary ways. First, we verify whether the value of parameter λ is negative when we estimate the model in equation (3) for the whole sample. Then we estimate the model for the two-year subsamples, as they are used in Figures 3 and 4.

Table 4 shows the estimates of equation (3) for the whole sample. The first pair of columns considers informal workers to be only those without a work card, whereas the second pair includes self-employed workers. The difference between the two columns of each pair is that the second one contains year dummies.

¹⁸This method is known as such because it is based on the subtraction of the value assumed by all variables in the model between periods t and $(t - 1)$. Note that this subtraction eliminates the unobserved component i from equation (2).



As shown in Table 4, the point estimates of the parameter associated with difference in the interaction $F_{it} \cdot u_{rt}$ (i.e., λ) are negative for both informal groups and for both specifications. However, these estimates are only statistically significant when we use the group of workers without a work card. In this regard, the prediction that the wage gap between the formal and informal sectors increases during economic expansion is confirmed, but not in a completely robust fashion.¹⁹

Table 4: Wage Regression Estimates in First Differences

2-9 Covariates/Specifications	Informal Workers						
	IE			IE and SE			
	1	2	3	1	2	3	
Δ_{rt}	0,0026 (0,0008)	***	0,0036 (0,0008)	***	0,0026 (0,0008)	***	0,0034 (0,0008)
ΔF_{it}	0,0918 (0,0026)	***	0,0916 (0,0026)	***	0,0841 (0,0027)	***	0,0845 (0,0027)
$\Delta(F_{it} \cdot u_{rt})$	-0,0075 (0,0037)	**	-0,0072 (0,0037)	*	-0,0044 (0,0038)		-0,0042 (0,0038)
Intercept	0,2675 (0,0006)	***	0,2531 (0,0012)	***	0,3165 (0,0006)	***	0,3013 (0,0012)
Year dummies	No		Yes		No		Yes

Source: PME Microdata (IBGE) from January 2004 to December 2008.

Notes:

- (1) The dependent variable is the logarithm of the real wage.
- (2) Standard error in brackets. Significance levels: (*) 10%, (**) 5% and (***) 1%.
- (3) IE stands for informal employee (no legal contract) and IE for self-employed.
- (4) The unemployment rate is calculated per metropolitan region's PME.

The estimated parameter of interest for the whole period can be close to zero as the result of variation over time, being negative in part of the sample and positive in the other part, as predicted by the theory. To tackle that possibility, the thin lines in Figure 5 show the estimates of the parameter of interest for the two-year moving windows with one-quarter increments in between, for the two groups of informal workers and for each of the two specifications considered in Table 4. The thick lines in Figure 5 correspond to the linear trends in the estimates presented in the figure. As can be seen, though there is some fluctuation over time, estimates are more negative for the initial subperiods but tend towards positive values as time moves forward. This is in line with the prediction of the theory that posits that

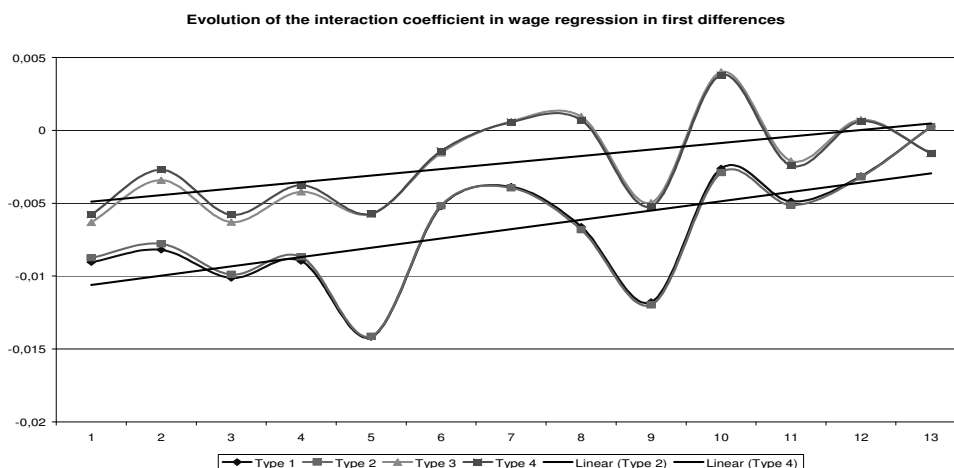
¹⁹The wage model was re-estimated for the two informal groups using the unemployment rate

- (i) lagged one month,
- (ii) lagged three months and
- (iii) the mean unemployment rate for the quarter.

The results (not shown) indicate that the parameter of interest is statistically significant for both groups and specifications, but has a positive sign in some cases.

the formal/informal wage gap increases at the initial stages of the economic expansion but tends to decline thereafter.

Figure 5: Evolution of the interaction coefficient in wage regressions in first differences



6. CONCLUSION

In this study, we sought to check whether a new theory that associates the dynamics of the labour market to business cycle expansions can explain the evolution of formal employment in Less Developed Countries (LDC). The theory, which is based on the poaching model put forward by Moscarini and Postel-Vinay (2009), advocates that the formality rate should go up as unemployment falls as a consequence of some change in the hiring strategy of formal firms. As the economy expands, the new workers in these positions come mainly from informal jobs rather than from the shrinking pool of unemployed workers. The theory also predicts that the wage gap between formal and informal workers increases, at least at the beginning of the economic expansion.

In order to verify the predictions of the theory, we analyzed data for the Brazilian metropolitan labour market between 2003 and 2008, a period of continuous economic expansion in this country. We presented evidence that, to a great extent, confirms both predictions. Thus, we offer an alternative explanation to that of the segmentation theory for the variations observed in formality rates in LDC.

One limitation of the theory is that the job-to-job flow in the labor market occurs only in the direction of low productivity (informal) to high productivity (formal) firms. Though in practice this is the more relevant flow in quantitative terms, the inverse one is also observed. We were able to confirm the main predictions of the theory for the informal-to-formal flow, but it would certainly be interesting to have a more complete model that is also capable to explain the reverse flow as well.

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