Chapter Five

Venue Aggregation, General Equilibrium, and Applications

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VENUE AGGREGATION, GENERAL EQUILIBRIUM, AND APPLICATIONS

Rational firms and households are tractably aggregated in this chapter, a critical step in the construction any macro model. The key to the exercise is the generalized-exchange requirement that meaningful aggregation be restricted to no fewer than two (marketplace and LEV workplace) venues of optimizing transactions. The two-venue minimum preserves critical technological heterogeneities between large, specialized firms and their small counterparts rooted in the Second Industrial Revolution. The former, characterized by costly, asymmetric workplace information and routinized jobs, must internalize labor pricing. The latter demonstrate cost-effective direct employee supervision or Class-II employment and can be simply subsumed into the familiar, broad market venue of exchange that prices and allocates most goods and services.

The chapter is divided into seven parts. The first section aggregates LEV workplaces while preserving micro-equilibrium properties of existence, stability, uniqueness, and economic meaningfulness. The second extends the aggregation exercise to the marketplace venue and models inter-venue interaction. A tractable version of two-venue continuous (decision-rule) general equilibrium is outlined. Next, a number of labor-related implications of two-venue modeling are considered, including frictional and involuntary unemployment, reservation wages, market and firm-specific hiring queues, quits, and hysteresis. In the fourth section, the TVGE theory is used to interpret some longstanding controversial macro facts, including the ubiquitous violation of the law of single wage, the employment volatility puzzle, the nature of longer-term unemployment, and the Dunlop-Tarshis challenge to Keynes. The fifth analyzes, as monetary phenomena, depression and stagnation. The former builds on Bernanke's benchmark model, while the latter uses Malinvaud as its primary link to the existing literature. The sixth section

examines the unique role of financial institutions in market-failure macro-mechanics, identifying a second critical TVGE meta-externality. Finally, there is a conclusion.

I. WORKPLACE EQUILIBRIUM

This section has two parts. First, the conditions producing existence, stability, uniqueness, and economic meaningfulness of individual large-establishment workplace equilibrium are summarized. Second, the micro analysis is used to motivate venue aggregation.

Single-Establishment Workplace Equilibrium

Existence.   The generalization of exchange in Chapter 2 identified conditions sufficient to support the existence of baseline single-establishment workplace equilibrium. They include:[1]

- Maximization of employer profit and employee utility;[2]

- The absence of a 1-1 technical correspondence of $\mathbf{X}_j$ and $\mathbf{H}_j$;

- Job separation into Class-I ($\mathring{O}^N/\mathring{O} < \mathring{I}^{\#}/\mathring{I}$) and Class-II ($\mathring{O}^N/\mathring{O} \geq \mathring{I}^{\#}/\mathring{I}$);

- The axiomatic bimodal separation of technology, rooted in (a) large establishments characterized by production scale and input specificities that result in costly, asymmetric workplace information and routinized jobs and (b) small establishments characterized by scale and input specificities that permit the effective monitoring of employee on-the-job behavior;

- A bimodal separation of initial household endowments of financial assets, with most deriving a small share of their income from wealth and the remainder deriving a large share.

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[1] Background assumptions posit a well-behaved production function, well-behaved worker utility, and a continuous workplace-exchange relation. Model tractability is facilitated by intra-firm labor homogeneity, risk-neutrality, and workers' inability to borrow or save.

[2] Employee utility notably reflects axiomatic employee preference for equitable treatment by management that motivates the spontaneous specification of workplace reference standards $\mathbf{K}_j$.

The critical technical and endowment assumptions have strong empirical support. They have been shown to imply, for the jth large establishment offering Class-I jobs, the existence of both a well-defined reference wage for its workers ($W^{\acute{n}}_j=\sup \mathbb{K}_j$) and a well-defined efficiency wage (W^n_j) for its compensation policy (max $\acute{Z}_j/W_j$)). Once derived from rational behavior, unbundled workplace exchange (in the range $W_j \geq W^m$) equilibrates the reference and efficiency wages, producing a rest period (at $W_j=W^n_j=W^{\acute{n}}_j=\sup \mathbb{K}_j$, $\acute{Z}_j=\acute{Z}^n_j$) in the space of intra-firm decision rules. Baseline LEV profit-seeking is consistent with downward-rigid labor pricing over business cycles, chronic labor rents, and rationing of jth-venue jobs. In Chapter 3, the hold-up problem, influencing profit expectations that govern firm capacity decisions, and implicit wage cartelization combine to make $\mathbb{K}_j$ (and the labor rent it implies) durable for substantial periods of time.[3]

Stability. Chapter 2 also demonstrates that the unbundled WER characteristic of LEV workplace equilibrium exhibits a critical asymmetry. A positive compensation shock (the wage paid increasing from W^n_j) has no effect on $\acute{Z}_j$, making a labor-price increase from the efficiency wage inconsistent with profit-seeking. There is no problematic gift-exchange. By contrast, a decrease from W^n_j centrally impacts $\acute{Z}_j$, reducing employee cooperation sufficiently to make wage-cutting inconsistent with profit-seeking. Consistent with empirical work, workers' deeply rooted urge to reciprocity is manifest only in a tit-for-tat response to wage cuts.

The asymmetry imparts stability to LEV workplace equilibrium that is compatible with the widespread reluctance of large firms to reduce nominal wages.[4] Both Samuelson's correspondence principle and the use of comparative statics are supported.

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[3] By contrast, workplace exchange must be bundled when information imperfections and job routinization are insufficient to prevent cost-effective workplace monitoring, frustrating the establishment of interpersonal and intertemporal reference standards and implying that $\mathbb{K}_k=\{W^a\}$. In SEV circumstances, profit- and utility-maximization produces a rest period in the space of workplace decision rules at $W_k=\sup \mathbb{K}_k=W_k^a=W^m$, $\acute{Z}_k=\acute{Z}^m_k$.

[4] Meanwhile, bundled workplace exchange, characteristic of small firms, produces stable equilibrium (at $W_k=W^m$), supported by the assumption of effective market-price discovery. Profit-seeking pushes against labor pricing greater than the market rate, while worker utility maximization (here motivating job mobility) pushes against wages that are below labor-market opportunity costs.

Uniqueness. The singular nature of large-establishment workplace equilibrium, closely related to stability, also follows from the central role assigned to the reference wage ($W^{\acute{n}}_j$). Employee-employer simultaneous optimization, constrained by unbundled workplace exchange, is organized around a single labor price anchored by uniquely specified reference standards ($W^n_j = W^{\acute{n}}_j = \sup \mathbb{K}_j$ where $\mathbb{K}_j = \{W^a, W^b, W^c\}$). Paying more than W^n_j, over the range $W_j > W^n_j$, pushes employers into decision-rule disequilibrium; paying less than $W^{\acute{n}}_j$, over $W_j < W^{\acute{n}}_j$, violates employee equilibrium. The baseline mandate to pay and accept, absent adverse consequences, the unique efficiency/reference wage implies the useful absence of multiple equilibria.[5]

Economic meaningfulness. The economic-meaningfulness standard requires that model solutions be consistent with the broad, evidence-based understanding of how modern, specialized economies actually work, providing an important test for policy relevancy. The continuous workplace-equilibrium narrative locates large-establishment labor pricing inside the firm, requiring the intentional firm-specific construction of mechanisms of exchange and uniquely generating wage market-rigidities sufficient to suppress recontracting and support involuntary job loss. Simply put, the TVGE model class provides the most practitioner-recognized description of labor pricing and use available in coherent economic theory. No other model, including the ubiquitous search/ match/bargain franchise, comes close. (See below.)

  Baseline Workplace Aggregation

Aggregation theory. A critical goal of aggregation is macroanalytic tractability, which comes at the cost of information that is lost at each step of the process. It follows that a necessary part of aggregation methodology is the identification of the information subset that, in order for the macro model to have meaning in its proposed applications, must be preserved. Macroeconomists rarely share their thinking, or lack of it, about information loss.[6]

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[5] For the bundled WER class, information-rich workplaces and effective labor-market price discovery combine to truncate the reference-wage set, i.e., $W^a = \sup \mathbb{K}_k = \{W^a\} = W^m$.

[6] In the current application (i.e., rigorous stabilization analysis and its implications for monetary policy), the judgment of this book is that meaningful wage rigidity is crucial and, therefore, information motivating distinct marketplace and workplace rational exchange must be preserved at the aggregate-model level. More generally, see Jesperson (2009), on the significance of methodological choice in macro modeling: "Macroeconomic results, such as policy recommendations, cannot be assessed independently of the methodology employed. This conclusion is

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BOX 5.1: FORMAL ECONOMIC METHOD AND HETEROGENEITY

Tractability is a central feature of usable macroeconomic models, making heterogeneity a scarce input to any analysis. Theorists must carefully weigh where to make that investment, identifying its most productive application in elucidating the problem at hand.

A crucial methodological choice in stabilization-relevant macroeconomics is whether to introduce large, specialized corporations, with their associated information, technical, and preference restrictions, into the population of firms. Absent that innovation, all firms are the familiar small, yeoman-farmer-type operations with all the simplifications that implies. The critical problem here is that those reductive establishments are inherent market-price takers, providing no coherent room for the meaningful wage rigidity that uniquely provides the rational link between nominal-demand disturbances and involuntary job loss. Only the MWR Channel can microfound stabilization relevancy.

The core choice to invest in bimodal firm heterogeneity is unusual in the macroeconomics literature. Attention has typically been paid to the introduction of heterogeneity that enriches market exchange, including product-market competitive imperfections, cyclical mutations of work-leisure preferences, variations in labor-market information, countercyclical use of arbitrary bargaining power, and variations in human capital. It will be demonstrated that none of those heterogeneities adequately informs stabilization-relevant theory.

If the problem is macro stability, the correctness of the less usual firm-heterogeneity choice is readily apparent with the demonstration that rational behavior within corporations rationally and uniquely generates the MWR Channel.

A fundamental concept in the management of information loss is the *economic venue*. A venue of exchange is defined as a locus of optimizing decision rules plus associated constraints and transaction mechanisms that produces consistent pricing for relevant goods and services. Venues provide limits to meaningful aggregation, preserving critical heterogeneities among interacting rational agents in coherent macro modeling. A *strong venue* produces constant relative prices; a *dominant venue* produces higher prices than all other (*subordinate*) venues. In the TVGE context, LEV firms provide the locus of decision rules that rationally prices point-of-hire equivalent workers higher than the labor market. LEV workplaces are dominant and the

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new insofar as there is very little overarching discussion of method to be found within the mainstream macroeconomic literature. Method is something to be used and rarely discussed. The absence of a discussion of method makes it difficult to interpret the analytical results for use in economic policy." (p.xii) Generalizing exchange is the fundamental methodological choice most necessary to support stabilization-relevant macro theory.

marketplace is subordinate, accommodating inter-venue labor-price inconsistency associated with market failures to clear.

Generalized-exchange theory restricts the aggregation of labor pricing to the now-familiar large- and small-establishment venues. Making room for that axiomatic heterogeneity does relatively little harm to macro-model tractability, while being sufficient to coherently introduce the technological and organizational nature of corporations into macro thinking. The powerful innovation is a wellspring of useful microfoundations, including rational underpinnings for the MWR Channel, involuntary job loss, and the discretionary management of aggregate demand.

Aggregation problem. Economists know that interdependent markets complicate macro aggregation. A disturbance in one creates immediate spillovers in other markets, creating feedback throughout the economy that critically prevents general model decomposability and the use of simple Walrasian adding-up methodology. To maintain single-venue general equilibrium in such circumstances, rational agents must contemporaneously solve excess-demand equations throughout the range of the economy's markets. The longstanding mainstream commitment to restricting optimizing exchange to the marketplace has made indecomposability the main barrier to coherent, tractable, policy-relevant aggregate-modeling.[7]

Providing the SVGE model class the capacity to derive operational stabilization and growth theorems requires aggregation that sufficiently circumvents the critical indecomposability problem. Most modern theorists have swallowed hard and settled on the representative agent.[8] The issue then shifts to the capacity of such a truncated analytical framework to preserve adequate information about large, specialized economies (differing, in so many respects, from a

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[7] Kuenne's (1963) thoughtful work on general equilibrium emphasizes inherent market interdependence and indecomposability. "This is a frequent mark of the general model, the source of much of the advantage it may possess over its less ambitious rivals, but the wellspring of its analytical impotence as well." (p.6)

[8] In the context of stabilization relevancy, one of the most problematic characteristics of the SVGE representative household is that it both supplies labor to and owns the single representative firm and, therefore, suppresses what is interesting about workplace exchange. It is fair to conclude that mainstream theory uses the representative household to closet aggregation problems that are broadly considered to be "just too hard". (Blundell and Stoker (2005, p.385) Woodford (2003), to his credit, frequently substitutes the more descriptive yeoman farmer.

collection of self-sufficient farms) to inform policy-relevant explanations and predictions.[9] The fundamental choice faced by SVGE theorists has never been pretty. Abandon rational microfoundations (in favor of atheoretic models that using available evidence to inform necessary free parameters) or convince oneself that tractability more than compensates for the badly non-intuitive, consequential restrictions implicit in single-venue representative-agent modeling. The hard fact is that the mainstream SVGE model has been constructed on little more than the hope that suppressing much of what appears descriptively important in economic behavior does not fatally compromise analytic results.

Enriching the economic method with optimizing, price-mediated workplace exchange greatly enhances macro-modeling power. A fundamental difference between large-establishment workplace and more general marketplace behaviors is that LEV labor pricing demonstrates contemporaneous decomposability.[10] The baseline workplace-equilibrium condition was derived for the large, specialized firm from axiomatic model primitives in Chapter 2:

(5.1) $\max_{W} (\acute{Z}_j/W_j)=\sup \mathbb{K}_j,$

where the familiar variables are defined in the Glossary.[11] The condition implies that each firm rationally solves its labor-pricing problem independently of other establishments, permitting unimpeded causation from $\mathbb{K}_j$ to W_j and $\acute{Z}_j$. The characteristic decomposability imparts substantial tractability to the TVGE model class. In particular, LEV labor pricing may be

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[9] See, for example, Kirman (1992). Edmund Phelps has surely won the general argument about the need to explicitly microfound macro modeling. Phelps' victory, however, is often misunderstood. It neither mandates the use of single-venue general market equilibrium to produce necessary microfoundations nor justifies the use of a representative agent to suppress the severe tractability problems of multi-market equilibrium.

[10] Recall that SEV labor pricing has been subsumed into the overall marketplace-exchange venue which, of course, includes a much greater share of the any macro model's endogenous variables than does the workplace-exchange venue.

[11] Recall also from Chapter 2 that $\mathbb{K}_j=\{W^a_j,W^b_j,W^c_j\}>W^m$. The interpersonal reference standard (W^b_j) requires some elaboration. By definition provided in Chapter 2 (i.e., other workers who perform the same or similar tasks as the individual employee or who work in close proximity to him or her), W^b is wholly jth-firm specific. The reference standard can be expanded to include corresponding wages in other firms without introducing the indecomposability barrier to aggregating variables in continuous equilibrium by an intuitive learning process, and its associated costs and inherent lags, with respect to relevant labor pricing in other firms.

homogenized and added up, with manageable information loss from individual-firm baseline equilibrium.

Homogeneity. The function of homogeneity assumptions is to support aggregation and analytic tractability. While substantial homogeneity is always essential for effective macro modeling, TVGE aggregation is constrained by attention to tolerable information loss. In the most compact version of generalized-exchange modeling, homogeneity assumptions are used to impose a singular reference wage on all large firms while still preserving critical characteristics of continuous-equilibrium LEV labor pricing:

(5.2) $W_J(t) = \sup \mathbb{K}_J(t) = W^n_j(t) \geq W^m(t)$, implying $\acute{Z}_J(t) = \acute{Z}^n_j(t)$. [12]

In the TVGE model, a set of homogeneity assumptions supports strong-venue LEV aggregation:

- Workers are homogeneous prior to obtaining employment in the large establishment venue.

- Employees in the large-establishment venue are endowed with identical workplace reference standards ($\mathbb{K}_J = \mathbb{K}_j$).[13]

- Technology/organization is homogeneous in the large-establishment venue (producing uniformly costly, asymmetric workplace information), homogeneous throughout the small-establishment venue (producing cost-effective labor monitoring), and heterogeneous between the two venues.

- The number of workplaces is finite.

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[12] The singular reference wage could be relaxed, supporting enriched analysis, to the imposition of a constant wage structure on the large-firm venue without compromising the workplace-equilibrium model.

[13] As noted above, this assumption can be relaxed, at the cost of a lengthier analysis, by generalizing W^b (in workplace reference standards $\mathbb{K}_j$) to include wages paid for the same or similar work in other firms (a venerable idea in labor economics, e.g., Arthur Ross's (1948) "orbits of coercive comparison"). The information supporting inter-firm wage comparisons would be produced via a lagged learning mechanism, replacing the perfect-information assumption and strengthening workplace-equilibrium results. (For example, see Honkapohja (2001).)

Those restrictions are sufficient to impose a single reference wage on all large-establishment workplaces, making the exact aggregation of cooperative worker input in the high-productivity venue a simple scalar of $\acute{Z}_j(t)H_j(t)$. The aggregated rational wage is $W_J(t)=W^n_j(t)$.

LEV dominant equilibrium is constructed on utility- and profit-maximizing, homogeneous workplaces that can be aggregated while preserving critical characteristics of establishment-specific equilibrium. As elaborated upon below, despite the baseline TVGE model's chronic violation of the market law of single (labor) price and its accommodation of involuntary job loss, employers and employees in both workplace and marketplace venues experience stable and unique rest points in their decision-rule space, producing a class of general equilibrium that microfounds macro-market failure and operational stabilization theorems.

Hicks-Leontief. The *Hicks-Leontief theorem*, developed independently by the two estimable theorists, provides a useful test of proper aggregation:

> A group of goods and services can be treated as a single good or service if their relative prices remain constant.[14]

TVGE modeling, with its homogeneity assumptions and decomposable workplace exchange, imposes a singular reference wage ($W_J=W^{\acute{n}}_J \geq W^m$) on all large establishments. LEV firms comprise a strong venue, the aggregation of which easily satisfies the Hicks-Leontief condition.

II. TWO-VENUE GENERAL EQUILIBRIUM

Bimodal firm heterogeneity enables the modeling of dynamic workplace equilibrium constrained by costly, asymmetric information and Class-I jobs. LEV equilibrium, reflecting a rest period in the space of employer-employee decision rules, has two especially compelling model-building characteristics. First, homogenization in support of workplace aggregation is not restricted by indecomposability. Second, workplace equilibrium dominates marketplace equilibrium.

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[14] Piero Sraffa (1960) analogously showed that constant relative wages imply consistency in product pricing sufficient to provide an interesting theoretical basis for effective aggregation. The continuous-equilibrium labor rents that result from rational workplace exchange can motivate the Sraffian methodology.

While the analysis so far has focused on the first characteristic, the second is also critical to the reconfiguration of coherent macroeconomics to be stabilization-relevant. Identifying the marketplace to be a subordinate venue with respect to labor pricing and use solves a lot of heretofore apparently insoluble problems. Given the ubiquity of labor usage and wage income in specialized economies, dominant LEV workplace outcomes broadly constrain decision-rule optimization in subordinate marketplace exchange. Endogenous, inter-venue restrictions on market decision-rule equilibrium enable TVGE accommodation of excess supply and demand.[15] The Two-Venue Theorem is validated, and the SVGE decomposability problem circumvented.

Aggregating Households and Firms

Homogeneity. The most tractable version of the TVGE theory confines venue heterogeneity to the production space, facilitating overall-model aggregation. Homogeneous households seek to maximize utility subject to stable axiomatic preferences and initial endowments.[16] They dispatch rational agents on two interrelated missions: exchange labor hours for income and exchange income for consumption goods or assets.[17] Homogeneous preferences, posited to be sufficiently regular to support representation by utility indicators, govern the variously constrained choices with respect to consumption verses leisure and the degree of on-the-job cooperation. Labor supplied by households is assumed to be point-of-hire homogeneous, but workers' incomes differ depending on the size of their employer and the nature of their jobs. Households furthermore seek to maximize expected utility from their financial holdings, as profit and interest distributions are exchanged for consumption goods and asset acquisition.

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[15] The point is critical. Introducing LEV labor pricing and use as a constraint on marketplace decision-rule optimization permits rest periods in that decision-rule space to coexist with demand-supply disequilibria. That coexistence allows the TVGE model class to sidestep the SVGE decomposability requirement, facilitating homogenization and effective Walrasian aggregation.

[16] It is useful to constrain household behavior with an unequal initial distribution of financial assets.

[17] Modeling rational consumption in the two-venue theory, a powerful exercise with substantial policy implications, occurs in Chapter 6. It should be reiterated here that, unlike SVGE modeling, TVGE preferences are axiomatic, broadly recognized by behavioral economists, psychologists, evolutionary biologists, and reasonably aware observers. (See below.)

BOX 5.2: ADVICE FROM SOLOW, PART II

In his iconic "A Contribution to the Theory of Economic Growth," Robert Solow (1956, p.65) offers some good advice on the use of assumptions, simplifying and crucial, in economic modeling: "All theory depends on assumptions which are not quite true. That is what makes it a theory. The art of successful theorizing is to make the inevitable simplifying assumptions in such a way that the final results are not very sensitive…. A crucial assumption is one on which the conclusions do depend sensitively. It is important that crucial assumptions be reasonably realistic. When the results of a theory seem to flow specifically from a special crucial assumption, then if the assumption is dubious, the results are suspect.

The TVGE model class satisfies the Solow conditions. Its simplifying assumptions, including the homogenization and aggregation of households, do not significantly distort its stabilization-relevant "final results", which are rooted in the existence of a robust MWR Channel derived from optimizing workplace exchange. The crucial stabilization assumptions (costly and asymmetric employer-employee information and routinized jobs) that govern the dominant workplace venue are more than reasonably realistic. They are axiomatic, so broadly accepted by practitioners to need no derivation. The axiomatic nature of the crucial assumptions of TVGE modeling is good news for stabilization-relevant macroeconomics.

Model tractability is best served by adopting standard textbook assumptions for SEV firms, making them autonomous entities that adopt the best available technology and default remaining decisions to the marketplace. Those crude establishments coexist with much more complex LEV corporations, endowing the TVGE production space with a bimodal separation of decision rules, constraints, and mechanisms of exchange. As has been described throughout, one venue is comprised of large specialized establishments offering Class-I jobs, confronting workplace information costs and asymmetries that unbundle their WERs and locate optimal wage setting inside the firm. Rest periods in the space of LEV workplace decision rules are consistent with dominant labor pricing and use. The other venue features small establishments or those offering Class-II jobs that, given bundled WERs induced by effective worker oversight or relatively strong job satisfaction, rationally locate wage determination in the labor market. Homogeneous SVE firms, making no operating decisions, are easily aggregated, absent the loss of significant micro-model information, and subsumed into the much larger subordinate marketplace venue of optimizing exchange.

Chronic wage rents. The TVGE model class enriches (relative to SVGE thinking) explication of the tradeoff between consumption and leisure in modern, specialized economies. In particular, the derivation of chronic wage rents from model primitives necessarily frustrates all workers. LEV workers confront rationed hours ($W_J > MRS_J$), while both SEV employees and the unemployed confront rationed high-wage jobs for which they are qualified. Constrained two-venue general (decision-rule) equilibrium recalls the Early Keynesian modeling of FWGE theorists, including Clower, Patinkin, Barro, Grossman, and Malinvaud. (See Chapter 6.) While those pioneers of stabilization-relevant formal macro modeling focused on implications for consumption, the repeal of Keynes's Second Classical Postulate broadly influences rational economic behavior, including investment, trade, and government taxation and spending.

Unlike the SVGE model class, coherent TVGE continuous equilibrium does not require, indeed is inconsistent with, general market clearing. Marketplace decision-rule optimization, once constrained by dominant LEV workplace labor pricing and use, accommodates a broad, stabilization relevant range of market supply-demand disequilibria, notably including chronic excess supply in the labor market. General rest periods in the space of constrained marketplace decision rules, freed from the stringent requirement of simultaneously immediate intermarket resolution of excess demands, accommodates rational learning-based behavior, including time-intensive price discovery. While TVGE markets grope toward more efficient price vectors, agents persist in continuous decision-rule equilibrium. Generalized-exchange theory dismisses the infamous Walrasian auctioneer. TVGE modeling provides room for practitioner-recognizable quantity signals and features price discovery. Intuitive learning happily replaces all-knowing auctioneers.

Continuous-equilibrium unemployment. The two-venue general-equilibrium treatment of unemployment has been notably enriched relative to its counterpart SVGE model class. The generalization of exchange microfounds two additional classes of joblessness that, along with textbook frictional job search, are accommodated in marketplace decision-rule rest periods.

First is the unemployment needed to reconcile inter-venue labor flows, rationed LEV jobs, and continuous economic equilibrium. As modeled in Chapter 3, Harris-Todaro conditions imply that

worker movement between high- and low-wage sectors is rationally governed by the labor-price premium and the subjective probability of acquiring a rent-paying job. Equilibrium Lewis-transfer unemployment results and is increasing in both the wage premium and rent-paying job prospects. (See also Chapter 6.)

Second is the involuntary job loss that results from suppressed LEV wage recontracting colliding with adverse aggregate-demand disturbances. Laid-off employees with recall rights are shown to most likely wait out their joblessness. Meanwhile, the rational behavior of job losers without recall is complicated by costly labor-market information. Time-intensive price discovery is needed to properly calibrate reservation wages in the aftermath of forced separation from rent-paying firms. (See below.)

Putting the pieces together. In the TVGE model class, rational agents engaging in labor-market exchange experience continuous subordinate decision-rule equilibrium consistent with chronic, variable excess supply. Macro manifestations of excess labor supply include recession, stagnation, and depression. Mainstream research has been unsuccessful at generating such instability by retrofitting endogenous intra-market constraints on rational SVGE decision rules. Exchange generalization has successfully provided the necessary constraints by recognizing an axiomatic second (workplace) venue. Again recall that such subordinate market equilibrium (given posited wage inflexibility) was modeled by FWGE theorists more than a generation ago.

TVGE tractability has been, on one hand, compromised by bimodal firm heterogeneity. On the other, tractability is greatly helped by both the effective absence of the decomposability problem in LEV workplace aggregation and the subordinate status of rational marketplace labor-pricing and use. Fundamental Walrasian questions concerning the properties of intermarket equilibrium are uniquely answered within the generalized-exchange framework.[18]

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[18] Notably, the Sonnenschein–Mantel–Debreu theorems on the aggregative implications of general equilibrium theory (excess–demand functions must be continuous and homogeneous of degree zero in prices as well as otherwise satisfying Walras' Law) are particular to optimizing market exchange and, in TVGE modeling, restrict neither dominant optimizing workplace exchange nor subordinate, constrained rational marketplace exchange.

Problematic Axioms

SVGE-existence restrictions are famously incompatible with actual economies, especially those featuring large corporations. General workplace equilibrium turns out to be a more manageable analytic anchor, enabling robust explanation of available evidence. Generalized exchange accommodates (but does not require) pricing power, incomplete markets, increasing returns, externalities, and joint products. Its critical assumptions, i.e., the existence of costly, asymmetric workplace information, a substantial subset of jobs that are routinized (offering relatively little nonpecuniary compensation), investment in firm-specific (sunk) capital, and employees who prefer fair treatment by employers, are proper axioms that are broadly accepted by practitioners.

General workplace equilibrium motivates meaningful wage rigidity capable of suppressing wage recontracting and generating the channel through which adverse nominal disturbances induce involuntary job loss. That second venue of rational exchange enables the explanation and prediction of a wide range of rational macro phenomena that are inherently incompatible with SVGE modeling.

Particularly interesting, once market decision rules are constrained by dominant workplace-equilibrium labor pricing, solving multi-market excess-demand equations becomes more tractable. Markets are no longer expected to enable agents to complete all their desired trades at going market prices. The bedrock economic method of optimizing price-mediated exchange, once extended to intra-firm transactions, is consistent with chronic excess labor-market supply and its associated inter-market spillovers. Workplace efficiency dominates marketplace efficiency, informing a tractable analytical framework within which theorists can powerfully model, consistent with continuous equilibrium, the wage rigidity, the quantity (good-job) rationing, and the causal real-side consequences of nominal disturbances that are universally characteristic of modern, specialized economies.[19]

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[19] The fundamental generalized-exchange innovation is pretty simple. Arrow and Debreu identified the assumptions needed for the SVGE existence of a set of prices at which markets' supply and demand simultaneously equilibrate. TVGE modeling derives a set of rational nonmarket prices that, even in the implausible circumstances that the Arrow-Debreu assumptions actually govern marketplace exchange, dominate market prices and thereby imply the nonexistence of general market-clearing equilibrium.

BOX 5.3: ASSUMPTIONS AND AXIOMS

In a contribution that ranks among the greatest in the history of economics, Arrow and Debreu (1954) identified the restrictive assumptions needed for single-venue general equilibrium to exist.

Arrow and Debreu elegantly identified conditions that assure the SVGE system of excess-demand equations has a market-clearing solution, including: (a) the absence of increasing returns; (b) the absence of joint products or externalities in production or consumption; (c) universal price quoting (implying the existence of forward markets for all final goods and services); (d) universal price taking (implying the absence of pricing power in all product and factor markets); and (e) gross substitutability of all goods (implying that an increase in the price of one good always produces a positive excess demand for at least one other good). Stability and uniqueness, much more problematic than existence for SVGE modelers, have eluded formal proof.

Arrow and Debreu, of course, never argued that their requirements actually characterize modern economies. They saw them as necessary conditions, not axioms upon which operational theorems can be derived. Yet, as the SVGE model class has been inexorably pushed forward as the proper framework for policy-useful macro analysis, the conditions have morphed into shadow axioms. Overt SVGE limitations on the capacity to explain labor pricing and use are instructively illustrated by the universal price-taking and price-quoting that require that all goods and services be priced in competitive markets, a restriction incorporated into the ubiquitous search/match/ bargain model that has been widely put forward as stabilization relevant. (See below.) It is, however, broadly understood by practitioners that worker cooperative input on the job, in the context of inherently costly, asymmetric workplace information, cannot be adequately observed, priced, or exchanged in the marketplace. Labor hours, which markets can measure and exchange, are an acceptable proxy for cooperative input ($\acute{E}$) only if employee OJB is cost-effectively monitored ($\acute{Z}_j = \acute{Z}^m_j$) or otherwise effectively managed. By definition, SVGE theory has no capacity to model the generalized exchange that developed in the aftermath of the Second Industrial Revolution.

The point is important and deserves emphasis. SVGE thinking is inadequate to the task of stabilization-relevant modeling of optimizing exchange in modern, specialized economies. Imagine that Debreu's (1959) research program to motivate SVGE modeling with intuitive assumptions (e.g., endowing commodities with delivery dates, location, and a context of relevant random events) had been tractably realized. The core model's fundamental limitation (i.e., its restriction of exchange to the marketplace) still confines it to being no more than a special case of TVGE analysis as well as a deeply misleading description of stabilization-relevant macrodynamic behavior. Moreover, in a great irony, it has become clear that clinging to the familiarity and comfort of SVGE thinking threatens the mainstream status of the formal economic method.

Mechanisms of Exchange

Economic theorists generally ignore exchange-organizing processes in both the (spontaneous) marketplace and (intentional) workplace venues. While not surprising, the model-building choice is consequential. It has damaged mainstream explanatory and predictive capacities, particularly with respect to the policy-relevant topics of employment and inflation. Mechanisms of exchange set prices and arrange what is exchanged for what, where the exchange occurs, and when. SVGE theory suppresses much of what is widely known about those essential economic processes.

Mechanisms of workplace exchange.   Workplace mechanisms that arrange and price the exchange of worker cooperative input for monetary compensation are globally apparent in specialized economies. Large departments responsible for human-resource management and compensation administration, operating under the direction of firms' profit-seeking leadership, are never absent in large establishments.

Tasks of those departments include identifying worker preferences and assessing the likely OJB feedback in response to a range of personnel practices. Within the context of the firm's working model of its employees, department administrators set wages and construct/administer workplace rules and procedures, perhaps subject to a formal bargaining framework with representatives of employees. (See Chapters 7 and 8.) The global ubiquity of such LEV workplace-exchange mechanisms, promoting the perception of fair treatment on the job to elicit employee cooperation with the goals of his/her employer, strongly supports workplace-equilibrium analysis.

From John Dunlop (1988, pp. 47-48): "Every workplace of size that persists over time develops and in turn is governed by its industrial relations system. Such a 'web of rules' emerges irrespective of labor organization or collective bargaining; no continuing workplace is ever truly unorganized. While there are literally scores of these rules in any workplace, the following headings provide some indication of their principal features: (1) Wage level and job classification structure and method of wage payment; (2) Fringe benefits: holidays, vacations with pay, health and welfare, pensions, *et cetera*; (3) Internal labor market movements: hiring, transfers, promotions, temporary layoffs, leaves, permanent layoffs, retirement; (4) Hours and

shifts, over-time and premiums; (5) Manning rules; (6) Safety and health; (7) Discharge and discipline; (8) Dispute resolution procedures; (9) Status of worker and management (and government) organizations and representatives; (10) Special rules shaped by the particular technology or markets."

Mechanisms of marketplace exchange. In constructing their iconic model of single-venue general equilibrium, Arrow-Debreu resorted to a fictitious information processor that provides a set of prices for which aggregate excess demand for all goods is zero. Translating that central processor into recognizable marketplace-exchange mechanisms is much more problematic than identifying their easily observable workplace counterparts. Simply put, SVGE thinking has no companion model of what or who sets prices or arranges exchange. Whatever the mechanism, it must be powerful, performing tasks that are orders of magnitude more difficult than those assigned to personnel departments. SVGE modeling requires, for example, the unspecified mechanism to endow all agents with complete information on current and future prices for all goods, while also enabling them to buy and sell as much as they desire at going prices.

Economists have sporadically worked on a plausible account of how competition produces multi-market equilibrium. Walrasian *tâtonnement* and continuous recontracting are understood to be inadequate explanations.[20] Exploration of alternative mechanisms such as random-meeting or specialized markets is in its infancy but also do not appear sufficiently robust to perform the extraordinarily difficult tasks that Walrasian equilibrium asks of any organizational process that sets prices and arranges transactions. Meanwhile, in the TVGE model class, optimizing workplace exchange powerfully constrains market decision-rule equilibrium, allowing rational agents to operate in continuous market-clearing disequilibrium and thereby substantially reducing the burden on market-exchange mechanisms. In circumstances of chronic and variable market failure, individuals are best understood as engaged in rational "groping" (via cost-

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[20] The reliance on the problematic, all-powerful auctioneer to coordinate rational individual choice in Walrasian *tâtonnement* simply suppresses the exchange-mechanism problem in order to secure an immediate, costless adjustment. The analytic convenience has no explanatory content. Edgeworth injected some content, describing a laborious (and SVGE inadequate) process of continuous bargaining in which individuals' conclude every exchange only when they are no longer rationally motivated to revise the terms of trade, a process rationally groping to equilibrium.

effective learning mechanisms) toward the market-price vector that is most consistent with constrained efficiency of generalized exchange.

Final Word on General Equilibrium

Robert Kuenne (1963, p.12) wrote clearly about general-equilibrium modeling, earning this section's final word. While speculating about the future of his specialty, he wrote "… there exists the possibility that in the future these general systems will be able to yield operational theorems by virtue of some Newtonian breakthrough in the area of multivariable analysis or, less fancifully, by simplifications of the interrelationship among the variables." A half-century later, a powerful simplification of variable interrelationships has been provided by generalizing price-mediated exchange, motivating a synthesis of workplace and marketplace decision-rule equilibria that microfounds stabilization-relevant aggregate modeling.[21] Unlike the mainstream use of the blunt representative household to simplify critical macro relationships, the dominant second venue is consistent with Solow's advice (Box 5.2) on proper aggregation. The critical assumptions governing workplace exchange are axiomatic and therefore easily satisfy the mandate to be "reasonably realistic".

III. MACRO IMPLICATIONS: UNEMPLOYMENT

Generalized-exchange modeling provides especially enriched accounts of the nature of joblessness in continuous decision-rule equilibrium. Despite generally available SEV jobs, much of the working-age population experiences labor-market failure. Many workers who are employed in the rent-paying venue have been pushed off their supply schedules and are frustrated by workweek restrictions on their consumption-leisure choice. Meanwhile, workers

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[21] The simplification, rooted in the construction of a second (dominant and decomposable) venue of exchange, is a grand jump in the development of macroeconomics. The significance of proper aggregation is inseparable from the significance of proper microfoundations. Thomas Stoker (1993, p.1871) cautioned economic theorists about "… the natural temptation to just create a 'story' to 'justify' common reduced form or representative agent models. The problem is that for any equation connecting aggregates, there are a plethora of behaviorally different 'stories' that could generate the equation, which are observationally equivalent from the vantage point of the aggregate data alone. If one invents a paradigm that is not consistent with individual data, or based on fictitious coordination between agents, the results of estimating an aggregate equation based on that paradigm are not well founded, and are not to be taken seriously."

who are unemployed or employed (except for those holding Class-II jobs) in the market-wage venue must prefer rent-receiving jobs for which they are qualified. But LEV employment is rationed, frustrating those who are able and willing to work in higher-wage jobs but cannot get hired.[22] Those workers are the involuntary, continuous-equilibrium population of the chronic excess supply to the rent-paying venue. From Phelps (1994, p.viii): "… much of what we measure as unemployment reflects job rationing, hence is involuntary and imposes private and social net burdens; the fact (if it is a fact) that there are some industries in which the wage moves to clear the market makes little difference."

Layard, Nickell, and Jackman (2005, p.11), in their ambitious analysis of joblessness, also draw attention to the explanatory power of the two-venue approach: "Even when unemployment is high, there are not queues for all vacancies. There is a secondary sector of the labor market that does more or less clear (e.g., in catering, cleaning, maintenance and repairs, and some retailing and construction). If people are unemployed, it is generally because they have decided against these jobs. They are however willing to work in a range of good 'primary' sector jobs, but cannot get them. In this sense unemployment is both voluntary and involuntary." [23]

This section is divided into four parts. The large first part, as promised, summarizes and assesses frictional unemployment and the ubiquitous search/match/bargain model of the labor market. The modern ubiquity of the S/M/B theory results wholly from its compatibility with the mainstream SVGE analytic framework. Subsequent sections more briefly consider heterogeneous market queues, job quits, hysteresis, and job downsizing.

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[22] Assumed homogeneity in workers' general human capital rules out structural unemployment rooted in mismatches between worker skills and firms' requirements. The absence of that important structural problem class focuses the immediate analysis on the nature and macro consequences of general workplace equilibrium.

[23] From Katz (1986, p.235): "If efficiency wage problems are not important in some sectors, jobs may always be available there. Jobs in the efficiency wage sector will still be rationed and offer a positive utility differential. Equivalent workers are treated differently even if there are always some (typically low-quality) jobs available. Unemployment may result from workers searching and waiting for the better, rationed jobs." Also, from Akerlof (2002, p.415): "The concept of good jobs and bad jobs makes the concept of involuntary unemployment meaningful: unemployed workers are willing to accept, bur cannot obtain, jobs identical to those currently held by workers with identical ability. At the same time, involuntary unemployed workers may eschew the lower-paying or lower-skilled jobs that are available."

Frictional Unemployment

Macro-labor theorists have a tough row to hoe, largely because they directly confront the inability of coherent SVGE modeling to suppress wage recontracting. Among their pressing problems, they must figure out how to generate, without involuntary job loss, high-frequency fluctuations in unemployment that are characteristic of business cycles. Mainstream (SVGE) macroeconomists who take model coherence seriously are reduced to coaxing cyclicality out of voluntary (i.e., frictional) unemployment, greatly taxing their creativity and credulity.

Frictional joblessness, denoted by U^F, results from the time required to match qualified workers searching for jobs and vacancies at firms seeking employees. Matching, which David Romer (2001, p. 445) is typical in describing as the "complicated process of employer recruitment, worker search, and mutual evaluation", is among the real-world phenomena most misunderstood by macro theorists.[24] It is instructive that frictional unemployment played little role in Early Keynesian thinking. The Neoclassical Synthesis, positing short-term wage rigidity, provided an operational framework for modeling and ameliorating forced job loss and cyclical unemployment. Early Keynesians envisioned no stabilization role for frictional joblessness.

As has been emphasized, however, Keynesian reliance on exogenous wage rigidity came at great cost, depriving their modeling the analytical anchor provided by continuous equilibrium. From Rogerson (1997, p.75): "The basic idea of macroeconomics at the time seemed to be that some unemployment could probably be understood in the context of the existing paradigm, but most of it could not. The key role of the language that was developed was to separate that part of unemployment that was 'understandable' from that part that was not. Frictional, voluntary and equilibrium unemployment were the names given to that part that was understandable using existing [SVGE] theory, while involuntary, cyclical and disequilibrium unemployment were the names given to that part that was not explainable in terms of received theory."

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[24] Analysts may be misled by personal experiences seeking Class-II employment at research universities. Matching functions used in the context of such faculty vacancies are by their nature time and cost intensive; they are likely sufficiently idiosyncratic to produce nontrivial match capital that is divided between the university and the new hire. Recruiters are even diverted from production. It may be uncharitable to point out here that matching cannot be complex in models aggregated on worker market homogeneity implicit in representative agent macroeconomics.

Early Keynesian inattention to frictional unemployment was challenged by the emerging mainstream rejection of wage rigidity not derived from optimizing behavior. The New Classical/RBC counter-revolution turned Keynesianism on its head by restricting analysts' attention to labor-market phenomena that can be coherently modeled within the consensus SVGE framework. Given that Pareto-efficient market-centric analysis, with its deeply embedded wage recontracting, cannot be made consistent with involuntary job loss and employment rationing, cyclical duties were forced on frictional unemployment. The voluntarily jobless were moved, by default but without apology, to the center of mainstream business-cycle analysis.

Modern search/match/bargain theory.[25] S/M/B theorists secured their centrality in SVGE labor-market analysis by identifying some diverting mechanics in the matching of the frictionally unemployed and firm vacancies. Modeling typically focuses on voluntary flows into and out of employment. Given an unchanged labor force, flow equilibrium occurs when new hires (H) equal job separations (D), assigning a critical role to a matching function (M) that relates unemployed job seekers (U^F) and unfilled job vacancies (V):

$$(5.3) \qquad H(t)=D(t)=d(t)N(t)=u(t)M(U^F(t),V(t)),$$

where the u represents matching-process efficiency and d is the proportionate rate of separation from N, which denotes total employment. The keystone variable u is posited to be increasing in H.[26] Further assuming that D is exogenous ($d(t)=d$), the central S/M/B relationship is:

$$(5.4) \qquad d=u(t)M(U^F(t)/N(t),V(t)/N(t)).$$

In S/M/B analysis, an exogenous change in the vacancy rate ($\Delta(V(t)/N(t))$) produces an opposite-direction change in the frictional jobless rate ($\Delta(U^F(t)/N(t))$). High-frequency fluctuations in

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[25] For an overview of the literature, see Diamond (1982), Burdett and Mortensen (1998), Mortensen and Pissarides (1999), Hall (1999, 2005b), Pissarides (2000), and Mortensen (2003).

[26] Matching functions can be made subject to thick-market effects, causing recruitment effectiveness to be increasing in the firm's recruitment effort. (See Romer (2001), p. 445.) More directly, matching-technology modeling has focused on variable firm resources (equivalently measured by output or employees) that are rationally allocated to transforming vacancies into jobs, affecting the average time job seekers spend in the U^F queue.

vacancies induce high-frequency movements in unemployment without resort to involuntary job loss. The continuous-equilibrium mechanics of equation 5.4 rely on variable matching efficiency. Given $\dot{H}$(t)=$\dot{D}$(t), an upward shift in vacancies requires an equivalent boost in hiring, which can be accommodated only by an increase in matching efficiency ($\Delta\psi$(t)>0). More efficient matching shortens the time job seekers invest in looking for work and, consequently, reduces U^F.

In the remaining piece of contemporary S/M/B modeling, Nash bargaining divides wage rents, generated in the idiosyncratic labor pricing inherent to the matching process, between the employer and newly hired employee. From Hall (2005b, p.51): "… the bargaining set for wage determination is relatively wide, because the difficulty in locating matches creates match capital the moment a tentative match is made. The value of the match capital determines the gap between the minimum wage acceptable to the worker and the maximum wage acceptable to the employer. From the perspective of bilateral bargaining theory in general, any wage within the bargaining set could be an outcome of the bargain. The Nash bargain sets the wage at a weighted average of the limiting wages, with a fixed weight over time."

Here is the wet blanket. The dominant status of the S/M/B model class in cyclical analysis is wholly the result of the consensus practice of arbitrarily restricting exchange to the marketplace. That model-building choice reduces mainstream labor-market theorems to pretty abstract stuff, imputing a bit of stabilization-irrelevant cyclicality to frictional joblessness. Untenable analytic burdens imposed on U^F generate at least three interrelated classes of problems:

- The most obvious policy-related difficulty is that involuntary job loss is the indisputable empirical engine of labor flows into and out of unemployment over the business cycle. (Recall Table 1.1.) The SVGE need to ignore that fact is the principal reason that so few useful stabilization theorems have been forthcoming from the enormous investment in S/M/B research.[27]

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[27] Shimer (2005, p.27), in a notable example, found that the mainstream S/M/B model cannot plausibly explain the large size of U.S. unemployment fluctuations at business-cycle frequencies, in part because the model has almost no internal propagation mechanism. Shimer further argues that the introduction of wage rigidities into the basic model allows it to do a "better job of matching the empirical evidence on vacancies and unemployment." The widespread finding that wage rigidities, or their surrogates, are critically important to the capacity of formal macro modeling to explain the available evidence is the elephant in the room in modern macroeconomics.

- Nash bargaining implies much greater downward flexibility of LEV nominal wages than is consistent with the evidence. Moreover, given labor homogeneity, the ubiquitous solution to Nash indeterminacy, i.e., an arbitrary employer-employee equal split of any available surplus over wage opportunity costs, cannot be consistent with profit-seeking.[28]

- In the market for LEV Class-I jobs, unit costs generated by worker-search and firm-hiring activities are transparently small. Substantial match capital is no more than an assumption of convenience, not fact. Consider a numerical example. If SEV employees know that a rent-paying establishment is hiring and the application process will cost one-day's pay, the combination of a 10% discount rate, a 10-year expected tenure on the new job, and the absence of job-changing costs implies a rational S/M/B wage premium of less than one-tenth of one percent. Meanwhile LEV firms, confronting vacancies among their rationed workforce (who receive wage rents well in excess of one-tenth of one percent), can simply collect applications from eager job-seekers who are either unemployed or are employed by a SEV establishment. LEV recruiters can, but not necessarily, check recent employment histories (typically looking for excessive absences). Providing more useful information about work habits and productivity than references, interviews, or any other part of the S/M/B application process is the typical probationary period for new hires, delaying their acquisition of the rights and full benefits accruing to LEV employees. Assuming that the matching technology (M) needed to fill routinized-job vacancies is particularly difficult or costly is simply wrong. For Class-I new hires, efficient matching processes do not generate significant Nash rents that must be divided between the new employee and his or her employer.[29]

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[28] The search-matching process modeled by SVGE theorists further implies either an incoherent wage structure (i.e., incoming employees are priced idiosyncratically) or adjustments to the firm's average wage level in the Nash surplus-division phase of recruitment. LEV management knows that either outcome adversely affects unit labor costs. It is not surprising that firms, already rationally paying chronic labor rents, have developed alternative, more cost-effective recruitment strategies. Existing workforces of large establishments costlessly disseminate information on their employer's rent-paying wage practices and hiring intentions among families and friends. The recruits are not required to be, and are probably not, presently unemployed. If the firm wishes wider distribution of its plans, paying directly for information dissemination (newspapers, other advertising, modest payments to existing employees for attracting applicants, etc.) is more cost efficient than attracting more applicants by increasing the offer wage. The direct outlay for information distribution is, unlike upward adjustments to labor pricing, a modest one-time cost that is targeted on recruitment and is limited to, and amortized over, the new hires.

[29] The LEV firm is already paying an efficiency wage that would dominate any idiosyncratic rents.

BOX 5.4: MORE ON THE CURIOUS CASE OF MATCH TECHNOLOGY

Modern theorists, working within the SVGE model class, often explain unemployment cyclicality by varying the intensity with which firms recruit employees, inducing changes in the average time job seekers spend in the frictional-jobless queue. That starring role for match technology is a Rube Goldberg approach to a phenomenon that is explicated much more simply, efficiently, and convincingly by the MWR Channel featured in generalized-exchange modeling.

<u>SVGE Thinking</u>
Roger Farmer (2010a, pp.18-22) provides an admirably clear, illustrative formulation of match technology in SVGE modeling. Using his notation, $Y{\leq}AX$, $X{+}V{=}L$, $L{=}qV$. "Y is output, $A{>}0$ is a productivity parameter, and X is the measure of workers employed by the firm in direct production. A firm that employs L workers may allocate them to produce commodities (this is the measure X) or to the recruiting department (this is the measure V). A firm that devotes V workers to recruiting will hire qV workers, where q is taken as given by the firm." (p.19)

Farmer's coherent model is powerfully restricted by $L{=}qV$. The absence of time robs the critical match-efficiency parameter (q) of meaning. Does the workforce turn over every 20 years? Every day? Moreover, q cannot be derived in the SVGE model class; it is always posited. Farmer's assumptions about the behavior of q centrally drive his analysis of cyclical unemployment.

<u>TVGE Thinking</u>
By definition, only LEV firms have personnel departments. For that venue, TVGE modeling tightly restricts Farmer's simple model, making match-technology trivial: $L{\leq}qV$, such that q is very large and V/L is very small. The triviality of $L{\leq}qV$ especially holds for the hiring for routinized jobs and is informed by the following:

- LEV firms pay wage rents, implying long job tenure and horizontal labor-supply composed of especially eager job applicants. Spontaneous queuing, supported by informal (friends/ relatives) information, is often more than sufficient to fill routinized-job vacancies.

- If the firm wants more applicants, cheaper methods than moving workers from production to recruitment are readily available, e.g. newspaper and other media advertising. The process of shifting employees between production and recruitment described in the match-technology narrative is so off-base that it does not pass practitioners' laugh test. It is the slenderest of reeds upon which to build policy-relevant models of job fluctuations.

- Most LEV job vacancies are for routinized jobs to be filled by nonsupervisory workers, a process generating little idiosyncratic match capital. In the introductory TVGE model, with its point-of-hire labor homogeneity, idiosyncratic match capital does not exist.

- Theorists appear misled by the typically large size of personnel departments. Relatively few personnel-department employees do recruiting. Instead, almost all contribute to the complex system of workplace-exchange mechanisms constructed by the firm in order to manage unit labor costs. Such workers cannot exist in SVGE modeling.

<u>Parting Thought</u>
That serious macroeconomists assign a central role to match technology in their attempts at policy-relevant modeling of employment instability is, at best, bewildering.

To reiterate, the central role of the U^F-and-V matching process in mainstream macrodynamics is a misleading artifact of arbitrarily restricted price-mediated exchange.[30] Using frictional joblessness to account for sizeable fluctuations in employment and unemployment is fundamentally at odds with how economies actually work and has become a wellspring for Ptolemaic thinking.[31]

Generalized exchange. In the TVGE framework, the S/M/B model class is returned to its original modest responsibilities. Resource-consuming job search focuses on rationed good jobs (i.e., LEV employment); SEV jobs are readily available. Given the capacity of continuous-equilibrium MWR to suppress wage recontracting in large, bureaucratic firms, generalized-exchange analysis does not require the frictionally unemployed to motivate cyclical unemployment. Instead, adverse demand disturbances, either as a nominal shock or propagating unfavorable real shocks, interact with the MWR Channel to damage profits and generate forced job loss.

The analytically convenient case of LEV job search being incompatible with concurrently holding a SEV job was considered in Chapter 3. It is, however, unrealistic to posit that workers cannot compete effectively for high-wage jobs while being employed in the low-wage sector. In the more credible approach, the labor market mediates flows between the high- and low-wage

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[30] The Award Statement of the 2005 IZA Prize Committee cites: "… the success of job search theory and the flows approach in becoming a leading tool for microeconomic and macroeconomic analysis of labor markets." The Committee emphasized that S/M/B models, "which are now widely used in labor economics and macroeconomics, have highly enriched research on unemployment as an equilibrium phenomenon, on labor market dynamics and cyclical adjustment." (The Statement is reproduced in Tatsiramos and Zimmerman (2011), p.vii.) It is an unhappy outcome, especially for policy relevancy, when our "leading tool" must ignore involuntary job loss. Who is willing to argue that TVGE analysis with its unique MWR Channel does not provide much superior explanations for a broad range of recognizable labor-related phenomena, including cyclical fluctuations in job flows, layoffs and job downsizing, unemployment duration, wage determination (especially relative to S/M/B indeterminate Nash bargaining), wage dispersion (especially with respect to firm size), and reservation wages?

[31] The hard fact is that nobody, perhaps excepting some macro theorists, believes that varying the intensity/ efficiency of how firms recruit and hire new workers is a significant determinant of joblessness over the business cycle. The evidence overwhelmingly indicates that the cyclical behavior of employment/unemployment is much better understood as motivated by nominal demand disturbances that combine with the MWR Channel to induce large swings in profitability and involuntary job loss – i.e., the Early Keynesian story. Indeed, a growing number of New Keynesian theorists are concluding that the S/M/B model cannot explain the behavior of policy-relevant fluctuations in unemployment, arguing that the analytical framework may instead be used to introduce the Super Friction that rationally suppresses wage recontracting. From Galí (2011, p.528): "… the presence of labor market frictions does not appear to have much impact on the economy's response to shocks. The indirect impact is, however, more substantial to the extent that it justifies the presence of sticky wages in equilibrium."

venues with variable search-unemployment costs.[32] (The assumption that labor is homogeneous with respect to innate ability, general human capital, and preferences continues to greatly simplify the analysis.) Joblessness, excluding frictional churning associated with weak SEV job attachment and labor-force entrants, is now populated by persons whose reservation wages exceed compensation (W^m) in the market-price-taking venue.

From Mortensen (2002, p.305): "… search theory implies that workers accept any wage offer above some reservation value when unemployed and then seek a higher-paying job once employed at an intensity that reflects expected potential gain in future income." Harris-Todaro labor-transfer summarized in Chapter 3 calibrates rational search (while SEV-employed or not) for a good job. Investment in search is increasing in both labor rents and the subjective probability of securing high-wage employment. In TVGE thinking, search activities include simply paying attention, via informal and formal information channels, to the hiring intentions of relevant LEV firms.[33] Moreover, as has been emphasized, chronic wage rents subsume any reasonable labor-price premium associated with match capital.

Reservation wages. A range of reservation wages ($W^n \geq W^R > W^m$) in the working-age population implies the existence of nonfrictional search unemployment. Generalized-exchange determinants of reservation wages are usefully divided into five classes. First are *heterogeneous preferences* governing the work-leisure tradeoff in the circumstances of rationed LEV (high-wage) jobs. Differing appetites for free time over work (consumption) make, for some portion of the labor force, SEV jobs unacceptable while LEV employment remains desirable, contributing to the rational existence of persisting search unemployment. New entrants to the labor force frequently fall (at least for a while) into this category.[34]

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[32] Newspaper reports in the recent Great Recession describe persons "… working two or three jobs as they looked for a good one." (*New York Times*, November 22, 2009, p.30) Such behavior, broadly accepted as factual, only makes sense in the context of interrelated wage rents, rationed high-wage jobs, and plentiful no-rent employment opportunities.

[33] That good jobs are rationed explains why those who already hold them are alert to notify family and friends about openings in their firm, an information-dissemination mechanism that is an important characteristic of labor-market search and matching in all modern, specialized economies.

[34] Heterogeneous worker preferences, however, violate a useful simplifying assumption of the introductory generalized-exchange model and will not be utilized, nor are much needed, in the analysis that follows.

Second is *imperfect worker information* about his or her market prospects, especially with respect to two interrelated factors: (a) the true probability of obtaining a LEV job and (b) the true market-opportunity wage. The latter is especially problematic in circumstances when rents paid in previous, now lost, LEV employment muddle workers' perception of their actual market price. Price-discovery learning processes with respect to both factors are understood to require time, suggesting that job-downsized workers are particularly vulnerable to long-duration joblessness.

Third is the *relative effectiveness of job search* by unemployed versus employed workers, which was considered in the previous chapter. Fourth and fifth are income-support programs related to involuntary job loss and the existence of laid-off employees' recall rights.

Applied macroeconomists have properly paid particular attention to the fourth determinant. Within the TVGE framework, *income support while unemployed* provides jobless workers more latitude to forego job openings in the low-wage venue and wait for opportunities to appear in the rent-paying sector. An increase in jobless benefits, broadly defined, puts upward pressure on both reservation wages and observed unemployment. The disturbance is structural, reducing potential output. In addition to benefit size, duration and generosity with which subsidies are administered matter. Empirical analyses reported by Layard, Nickell, and Jackman (2005) are typical in finding that all three dimensions (the income replacement level, the length of eligibility, and the standards used to qualify) influence cross-national unemployment differences, with heterogeneity in the benefit duration being most important.

Jobless compensation, especially when continued benefits require job search, influence economic outcomes largely by converting disguised labor-market failure (manifested by workers qualified for high-wage, rationed jobs being employed in the low-wage sector or by discouragement that results in discontinuing active job search) into measured lower-frequency unemployment and stubbornly high reservation wages.[35]

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[35] Persistently high measured unemployment, concentrated in the longer-term jobless, that followed the 2007-09 recession in the United States partly resulted from extending U.I. benefits from 26 to 99 weeks.

BOX 5.5: INVOLUNTARY UNEMPLOYMENT EXPLAINED

The greatest contribution of the New Classical insurgents has been their insistence on the formal economic method in mainstream macro modeling. In perhaps the most remarkable individual contribution to the rule of SVGE coherence, an important leader of that revolution convinced many good theorists, most of whom want to be taken seriously by stabilization policymakers, to ignore involuntary unemployment. Robert Lucas's memorable message is that the writ of serious research does not extend to Keynes's central concern: "Involuntary unemployment is not a fact or a phenomenon which it is the task of theorists to explain…. It does not appear possible, even in principle, to classify individual unemployed people as either voluntarily or involuntarily unemployed depending on the characteristics of the decision problem they face. One cannot, even conceptually, arrive at a usable definition of full employment as a state in which no involuntary unemployment exists." (Lucas (1981), p.243) The TVGE model class, with its generalized-exchange framework for constrained decision rules that are optimized in specialized economies, easily resolves Lucas's reservations, introducing stabilization-relevant involuntary joblessness into rigorous, continuous-equilibrium macroeconomics.

One of the best supported facts about U.S. recessions is that most of the increased unemployment results from involuntary lost jobs (ILJ). (See Table 1.1.) Demonstrating the continuous equilibrium existence of ILJ also demonstrates the continuous equilibrium existence of involuntary unemployment. The overall exercise requires answers to three questions. First, who are the involuntary job losers? They are sufficiently identified by a suppressed decision problem. They were not offered, in lieu of losing their rent-paying jobs, a wage reduction that did not violate their market-opportunity costs.

Second, why don't job losers quickly accept their best alternative job? Once again, the key is that ILJ inherently involves wage rents. Such rents greatly complicate joblessness by motivating the rational rejection, in plausible circumstances, of the best available job, illustrated here by two examples. Rationed rent-paying jobs, for which job losers are qualified and would accept but cannot obtain, motivate joining the continuous-equilibrium Harris-Todaro unemployment queue ($\hat{U}^R$). In addition, job losers can rationally remain unemployed during the period of price-discovery required to correctly calibrate the rent received in their previous employment. That costly information is necessary in the determination of true market-opportunity costs.

Third is the jackpot question. Why doesn't the employer offer a wage cut that would prevent the forced job loss? The generalized-exchange model class has derived (from axiomatic model primitives) continuous-equilibrium meaningful wage rigidity (MWR), featuring cyclical downward nominal rigidity and chronic, variable rents, that rationally suppresses LEV wage recontracting. MWR satisfies the Barro critique and uniquely microfounds involuntary job loss and unemployment, easily solving the most consequential problem in macroeconomics.

The fifth determinant, *layoffs with recall*, also influences reservation wages. (Recall Chapter 3 and see below.) Forced job separation that is, from the perspective of the firm, temporary occurs in the rent-paying venue, resulting from wage rigidities interacting with adverse stationary demand disturbances. If involuntary job losers are endowed with recall rights, the resulting unemployment differs from other types of joblessness. Laid-off workers have first call on their former high-wage jobs once the firm again funds them. Such quasi-property rights influence the worker's range of options while unemployed. The rationality of the laid-off worker accepting a SEV job is now influenced by (a) whether the new employment compromises his or her recall rights and (b) whether the market wage is greater than his or her reservation wage, i.e., opportunity cost of unemployment, including any jobless benefits and worker's nonpecuniary costs of taking a lower-status job.

Opportunities in the SEV sector that satisfy the laid-off-with-recall worker's requirements are limited, especially if there are hiring and training costs associated with the new job. The firm must amortize such costs over the expected period of employment. The shorter the period, the greater the costs that must be deducted from the wage paid. If the small firm expects a relatively quick recall of an applicant to his or her previous rent-paying job, even modest new-hire costs may require marking down its offer wage significantly, increasing the likelihood of being less than the laid-off worker's opportunity costs of remaining unemployed.

Two models. The nature and structure of unemployment consistent with coherent SVGE modeling differs significantly from joblessness produced in the TVGE framework. In the former, jobless workers are voluntarily unemployed, searching for a satisfactory job match. Absent money illusion rooted in Lucas-class market-information imperfections, nominal demand disturbances do not affect joblessness, fluctuations in which are instead governed by stochastic real shocks interacting with the efficiency and intensity of recruitment and matching activities. Even permitting Lucas-class unemployment, there is no room in SVGE labor markets for the beneficial discretionary management of total nominal spending.

In the TVGE model, endogenous involuntary job losers are added to those who have voluntarily separated from their previous job or have just entered the labor force, all of whom are seeking

satisfactory employment. Forced job loss is countercyclical, while voluntary quits are procyclical. (See below.) Unemployment fluctuations, dominated by job loss, are little influenced by voluntary job separation. Models that assign a central cyclical role to frictional unemployment make no sense in specialized market economies and cannot be stabilization-relevant. TVGE analysis, in pushing workers off the LEV labor supply curve and rationally suppressing work-leisure substitution, also deduces from axiomatic preferences and technical constraints the coexistence of relatively high and near-zero labor-supply elasticities that are conditional on venue location.[36]

Heterogeneous Queues

Generalized exchange has been shown to shed considerable light on the nature of unemployment in specialized economies. Its varied results approach contrasts with coherent SVGE theory, which focuses wholly on workers' voluntary participation in market queues (of varying lengths), waiting to be matched with available jobs. More catholic TVGE modeling separates continuous-equilibrium unemployment into two classes:

- The number of persons in the market queue ($U_{\dot{S}}(t)$); and

- The number of persons laid-off with recall in nonmarket (firm-specific) queues ($U_{\dot{L}j}(t)$).[37]

The length of the market queue ($U_{\dot{S}}(t)$) is inversely related to the number of temporarily laid-off workers in the nonmarket queue ($U_{\dot{L}j}(t)$). The market queue has been substantially enriched in the

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[36] The role of real models (Ramsey (1928) and Diamond (1965)) that have been extended in order to fine-tune work-leisure choice, frequently providing the starting point for modern SVGE macro thinking, is sharply reduced in the TVGE model class. In the LEV venue, given the requirements that factor specificity impose on the organization of production, firms sharply limit the capacity of workers to vary their weekly hours. (Even overtime is frequently mandatory, and absenteeism is a significant cost that is closely monitored.) Employers can override employee preferences here because of the payment of wage rents and the consequent rationing of "good" jobs. In the SEV venue, weekly hours are more variable, as competitive pricing and use of labor services permit households to be more responsive to their work-leisure preferences as well as variations in the offer wage. More generally, I have toyed with using overlapping generations in explicating TVGE modeling. At least in those preliminary efforts, neither the analytic nor policy payoff was anywhere near sufficient to justify the increased clutter.

[37] Recall rights held by laid-off employees generate firm- and worker-specific reemployment queues, implying that the temporarily jobless workers may never join a market queue. Moreover, workplace modeling has more richly interpreted market queues as a permanent buffer between LEV and SEV employment, helping to reconcile their inherently inconsistent labor-pricing practices.

TVGE model class, usefully separating it into frictional and wait (reservation-wage) unemployment. The latter is increasing in both nonstationary wage rents (G^T(t)) and workers' subjective probability of securing a LEV job.

Quits

The evidence indicates that quits, which are inherently voluntary, move inversely with the jobless rate, receding in recession and rising in expansion. That behavior is consistent with the TVGE model, where voluntary job separation is concentrated in the SEV sector. Increased hiring by high-wage firms, spurred by expectations of more robust demand for the goods they produce, would draw down their applicant queue and induce more quits by low-wage workers.

That was deceptively easy, given that quit patterns consistent with actual behavior have been chronically difficult to derive in rigorous New Classical/RBC (SVGE) modeling. Early search theory, motivated by Lucas's assumption of worker confusion about the true nature of nominal wage changes, predicted a positive relationship between quits and overall unemployment. And the difficulties with the evidence continues; in coherent SVGE modeling, even after decades of work on labor flows, quits remain the primary determinant of cyclical joblessness. A compelling feature of TVGE theory is that it requires no counterfactual burdens on voluntary turnover to produce meaningful employment fluctuations.

Hysteresis

Phelps (1972) introduced the concept of hysteresis, in which the deterioration in worker human capital is increasing in unemployment duration. In the SVGE model class, the time-sensitive reduction in human capital is hypothesized to explain the empirical fact that, for workers who involuntarily lose their jobs, wages received in subsequent jobs are likely to be significantly lower than labor pricing in the employment that was lost. Reflecting that process, Phelps posited that measured nonstationary joblessness depends on past rates of unemployment.

TVGE modeling provides alternative, interrelated explanations for both lower subsequent wages and longer-duration joblessness. LEV jobs are rationed and, absent recall rights, involuntary job losers will most likely end up with lower-paying SEV jobs. Moreover, as described above, those victims of involuntary LEV job loss have imperfect understandings of the size of the wage rent received in their previous employment. It takes time to accumulate information sufficient to convince them of their true market opportunity cost; in the interim, they resist lowering their reservation wage. While on their learning curves, they likely experience multiple spells of unemployment (accepting stop-gap SEV jobs for short periods) before they settle into employment that pays significantly less than their previous LEV positions. (See Summers (1990).) Average unemployment duration is increasing in the share of job losers in total joblessness.

Job Downsizing

Job downsizing influences economic welfare and is poorly accommodated in mainstream macro modeling. Little has changed in the academy since Lori Kletzer's (1998, p.130) assessment: "Existing research [on job destruction] has tended to focus on who gets displaced, how soon they are reemployed, and at what earnings. But we know very little about the fundamental causes of why displacement occurs." TVGE theory greatly enhances economists' capacity to model job downsizing as a continuous-equilibrium, policy-relevant phenomenon.

In the TVGE model class, macro disturbances generate employment destruction via adverse effects on nonstationary LEV pure profits, becoming part of the larger effort to provide a proper place for residual rents in formal theory. (Recall Chapter 3.) Generalized exchange has helped identify an intuitive set of macro-relevant shocks that influence job downsizing: import competition, persistent stagnation, and terms-of-trade shifts against labor. Each of the three phenomena is usefully explicated in two-venue analysis.

In specialized economies which exploit production scale and variously accommodate sunk capital, hold-up problems, pricing power, and industry wage cartelization, the interaction of utility-maximizing employees and profit-seeking employers implies substantial intertemporal

persistence in the efficiency wage (W^n). But, as demonstrated in Chapter 3, there exists dynamic upper limits on wage rents ($G(t) \leq \bar{G}(t)$), beyond which $\mathbb{K}_j$ durability is damaged by job downsizing. Increased import competition or chronic stagnation tends to push G down, while adverse shifts in labor's terms of trade (given a sufficiently compact wage structure) push G up.

Adequate analysis of stagnation and stagflation is beyond the reach of SVGE macro modelers, resulting in generally deficient understanding of the phenomena themselves as well as badly designed and interpreted empirical testing. Import competition, by contrast, is a relatively transparent process. Its empirical analysis has been useful to policymakers and strongly supports the TVGE theory. Typical of the early wave of modern work are Haveman (1994), Addison, Fox, and Ruhm (1995), and Kletzer (1999). Haveman's findings are illustrative. Using U.S. data, he found that a 1 percent annual decline in industry import price was associated with more than 1.5 percent rise in job destruction; for a subgroup of import-competing industries, the job-downsizing response was 3.5 percent. Earlier, Annable (1984) used the G-versus-$\bar{G}$ framework to analyze labor-cost bankruptcies and accurately predict their continued march through basic manufacturing in the United States.

IV. MACRO IMPLICATIONS: INTERPRETING LONGSTANDING FACTS

Predictions and evidence. Workplace-equilibrium analysis introduces a separate class of optimizing exchange into formal macro theory, usefully synthesized with the highly developed marketplace model. The new class of economic equilibrium is constructed on technological heterogeneities that are captured, in the basic model, by an establishment-size bifurcation. The two-venue approach substantially enhances our capacity to explain and predict economic phenomena. An extensive review of relevant evidence is postponed until Chapter 10, but it may prove useful to preview those findings with respect to a few especially policy-relevant topics.

Workplace-marketplace synthesis notably predicts a set of characteristics for the labor force and employment in modern specialized economies:

- Jobs are rationed in large, specialized establishments, while being much easier to get in small firms characterized by effective workplace monitoring.

- In contrast to the substantial payoff resulting from long job tenure in the high-wage sector, jobs paying market rates provide relatively little benefit from long-term employment. SEV employees optimize at the work-leisure margin, producing voluntary job turnover that is much higher, and labor-force attachment much weaker, than for LEV workers. Given wage rents, the latter are pushed off their market-supply schedule and optimize their OJB rather than worker-leisure choice.

- Workers expelled from high-wage jobs would typically experience, especially if jobless benefits exist, frequent spells of unemployment interspersed among relatively short periods of low-wage employment before settling into a job that pays significantly less than the involuntarily lost position.

- The rate of product-demand growth in the large-establishment venue governs the absorption of workers transferring from the low-wage sector. The nonstationary length of the queue awaiting admission, contributing to unemployment and underemployment, is increasing in nonstationary wage rents and the subjective probability of obtaining a LEV job. The stationary component of joblessness reflects the influence of high-frequency residual-rent fluctuations with respect to LEV layoffs and recalls. Job quitting, concentrated in low-wage employment, moves inversely with the length of the market queue.

- Reservation wages of the unemployed workers successfully seeking to transfer from the low- to high-wage venue would exceed the rate received on their last job.

The predictions are broadly supported by the evidence. In a detailed study of the U.S. labor market, Summers (1990, p.39) reported that a substantial part of total measured unemployment is caused by the same people experiencing multiple jobless spells interspersed among short periods of employment: "Even over fairly long periods, the burden of unemployment is highly concentrated. An individual who is currently unemployed can expect to be unemployed six months out of the next twelve, and one year out of the next four years."

The 1974-75 recession in the United States was the worst downturn since the 1930s, suggesting a sharp increase in job rationing in the large-establishment, specialized venue and a breakdown in

the absorption of workers from the low-wage sector. Summers found the following: "The number of persons with more than six months of unemployment rose more than fourfold between 1969 and 1975." (p.39) Finally, the evidence supports the notion of high reservation wages among many of the unemployed. Using the same mid-1970s period of low LEV job growth, almost a quarter of the jobless in 1976 reported reservation wages more than 20% higher than their last wage. (p.41)

Wage rents. The available evidence indicates that meaningful wage rents exist and that they vary in size over time. The most notable example, Katz and Summers (1989), has already been summarized in Chapter 1. To reiterate, they found substantial unexplained U.S. inter-industry wage differences after accounting for worker quality heterogeneities, suggesting mean rent magnitudes on the order of 30 to 40%. It is additionally noteworthy that the data indicate that, in industries with high output value per unit of input, the surplus was wholly claimed by labor; shareholder returns were not sensitive to inter-industry differences in productivity.

Meaningful, variable wage rents would intuitively be expected to play a significant role in both high- and low-frequency behavior of employment and production. Yet they are an orphan topic, rarely modeled empirically and wholly absent from modern formal economic theory. The principal reason for theorists' lack of interest is that meaningful wage rents are inconsistent with SVGME (even in its friction-augmented version) modeling. Macroeconomists are extremely reluctant to venture outside their market-centric comfort zone.

Employment-volatility puzzle. The proximate postwar equality between the standard deviations of labor hours and real output in the United States is suggestive of quantity rather than price adjustments to macro shocks. As a result, the puzzle is recognized to be among the thorniest empirical problems confronting mainstream macro theorists. To be compatible with coherent SVGE modeling, the employment-output dynamic lockstep requires implausibly high labor-supply elasticities, casting doubt on the existence labor-market decision-rule equilibrium.

Employment volatility, of course, is not at all puzzling to TVGE theorists. Indeed, the high-frequency co-movement of output and hours is a central prediction of their keystone MWR

channel; the absence of the "puzzle" would falsify the workplace-marketplace theory. The hard fact is that NNS theorists have not only failed to identify frictions from their SVGME-endogenous set that adequately explain stationary labor-quantity adjustments, they are doomed to never succeed. For modelers working within the coherent SVGME framework, the puzzle's persistence is rooted in the nonexistence of its solution.[38]

Most macroeconomists know that assessment must eventually be accepted. Involuntary job loss and the necessary suppression of wage recontracting are too important in the actual behavior of modern, specialized economies to be ignored in policy-relevant theory. For example, while continuing to underestimate the difficulty of SVGME labor-related modeling, Danthine and Donaldson's (2003, p.66) assessment of the state of NNS research reflects mounting discouragement: "…we are not yet ready to decide which friction should be part of the right, parsimonious, description of the labor market in dynamic stochastic general equilibrium models. There is an abundance of observationally equivalent candidates and we are short of discriminating, significant, facts. This is disappointing. Focusing on the labor market seemed a sure recipe for identifying 'necessary' frictions! In this domain, one is forced to accept the view that, at this point, theory is ahead of (significant) business cycle facts." The other possibility, identified in the TVGE model class, is that consensus SVGE theory is incapable of accommodating the facts.

Long-term unemployment. By the end of the 2007-09 recession in the United States, more than a third of the total unemployed had been actively looking for work for more than six months, the highest proportion since the beginning of the monthly employment survey in 1948. The SVGME macro model class, emphasizing job-search and matching costs in its explanations for unemployment, has particular difficulty explaining long-term joblessness while the WMS, by contrast, easily explains the breakdown labor-market efficiency.

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[38] The favorite SVGE explanation for the employment-volatility puzzle remains the indivisible labor-supply hypothesis (Hansen (1985)), Rogerson (1988) that posits agent inability to adjust the length of his or her workday. In that approach, costs of going to work and/or supervising worker OJB impose a binary choice on households (work full-time or not at all), creating lumpiness in the optimization process. See Chapter 6.

As modeled earlier in this chapter, the WMS interprets market-queue participation as resulting from job separation or labor-force new entrants or reentrants. Those who were employed can have voluntarily quit their previous (small-establishment) jobs; or they can have permanently lost their previous high-wage jobs. WMS endogenously models labor rents and predicts relatively high reservation wages to be characteristic of workers who have experienced the permanent loss of high-wage jobs and for whom job search is needed to help them size the rents received in their former employment and better understand their true market opportunity costs.

Employment and real wages. The TVGE assignment of a central role to labor pricing in the dynamic path of employment is not unusual. Macro theorists have typically posited an inverse relation between total employment and the real wage in their aggregate models. Generalized exchange, however, provides a richer specification of the wage-employment relation than does the market-centric model class.

Stationary nominal disturbances interact with market-insensitive W^n_j to induce high-frequency residual-rent cycles in the large-establishment venue, motivating sequential periods of layoffs and recalls/hiring and an inverse relation between employment and stationary wage rents (G^V).[39] It is here that systematic monetary policy helps stabilize the macro economy. However, inverse relationships between employment and real wages have been, for a long time, empirically controversial. The debate began immediately after the publication of Keynes's *General Theory*, when John Dunlop (1938) and Lorie Tarshis (1938) separately examined available evidence and reported that average real wages do not move countercyclically.

A large body of empirical evidence, accumulated over the past 70 years, particularly in North America, supports the Dunlop-Tarshis findings. Abraham and Haltiwanger (1995, p.1262) surveyed the literature: "To sum up, correcting for all of the measurement problems, estimation problems, and composition problems does not lead to a finding of systematically procyclical or countercyclical real wages. Unlike some other macroeconomic regularities (for example, the procyclicality of output, consumption, investment, and employment, and the greater volatility of

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[39] As noted by Layard, Nickell, and Jackman, (2005), the mainstream specification of the inverse relation between real wages and employment is consistent with both market-disequilibrium (new Keynesian) and market-equilibrium (new classical) interpretations. See below.

investment than consumption), the cyclicality of real wages is not likely to be stable over time." Other investigators, e.g., Geary and Kennan (1982), have concluded that the average real wage in industrial countries ranges from acyclical to moderately procyclical.

The evidence is persuasive. Measured real wages, on average, are mostly acyclical. That conclusion, however, is not inconsistent with macro adjustments predicted by workplace-equilibrium theory. When wage determination is heterogeneous, occurring in large- or small-establishment venues, the appropriate labor-pricing variable in the analysis of monetary disturbances is the stationary behavior of real (producer-price) wage rents (G_{RP}^V); if stationary wage rents increase, employment decreases relative to its nonstationary trend. Sector heterogeneity contributes to three types of effects that make the use of average real wages misleading in Dunlop-Tarshis inspired empirical exercises.

First is the *compositional effect*. The optimal wage in the large-establishment venue has been shown to be independent of contemporaneous labor-market conditions, eliminating any direct influence from changes in the unemployment rate. To the extent that specialized-venue product prices are sensitive to declining sales, liquidating inventories, and production cutbacks, the measured large-establishment real wage is countercyclical. By contrast, the real wage in the market-price-taking venue is influenced by contemporaneous market conditions, moving procyclically.

Taken together, the two wage-setting venues produce stationary movements in mean real wage (deflated with an economy-wide average product price) that at least partially offset, making the average real wage more acyclical. Mean acyclicality requires the real (producer-price) large-establishment wage to be countercyclical. Over the business cycle, wage rents (which in workplace-equilibrium analysis have the inverse relation with employment) are substantially more volatile than the measured average real wage.

Second is the *relative growth effect*. Employment absorption of the job-rationed specialized sector is procyclical. Relatively large wage increases received by workers moving from the low-

productivity to the high-productivity venue, and the big reductions that occur in the other direction, impart a procyclical bias to the measured behavior of average real wages.

Third, and most fundamentally, nominal wages must be deflated more carefully than has been the practice in the empirical literature. Especially complicating here is that product markets in disequilibrium imply that the product price appropriate in the wage-deflation exercise is notional, reflecting the downward adjustment necessary to clear the market. In the LEV, the drop in product prices needed to clear markets after a significant demand disturbance would likely be relatively large (especially when the adjustment is complicated by inventories), translating the nominal efficiency wage consistent with workplace equilibrium into a sharply higher notional (producer) real wage, supporting its interpretation as countercyclical.[40]

V. MACRO IMPLICATIONS: DEPRESSION AND STAGNATION

In this section, the TVGE model class is used to begin sketching the macroeconomics of depression and stagnation.[41] Greater attention is paid to depression, which is loosely characterized by virulently contracting nominal aggregate demand, sharp increase in involuntary job loss, and asset/product price deflations followed by persistently high unemployment, wealth destruction, and chronically depressed real income and capacity utilization. Those characteristics, writ large, made the interwar global depression the most significant economic episode of the 20th century as well as the most difficult for modern (SVGE) macro theorists to

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[40] It should also be noted, in the context of the Dunlop-Tarshis critique, that chronic shocks in the terms of trade or productivity growth can occur simultaneously with business cycles, affecting real wage dynamics and obscuring high-frequency influences on labor-price measurement. Real wage rents must be decomposed in order to separate the consequences of chronic shocks from transient effects of monetary disturbances in the analyses of the cyclical behavior of real wages. If the accumulating adverse effect on employment prospects from unsustainably high wage rents is aggravated in recession and masked in expansion, the timing of long-simmering and carefully prepared workplace reference-standard revisions will have a cyclical dimension. The effect, not short-term in any analytical sense, imparts some apparent procyclicality to real wages. All in all, the famous debate could have been more quickly resolved if early John Dunlop had discussed the issue with early Richard Lester.

[41] From Chapter 3, recall that LEV firms, while always paying wage rents, cannot organize rational nominal wage cuts in a high-frequency SDD context. The NDD classes, however, is a different story. In both depression and stagnation, persisting downward pressure on actual and expected profits triggers job destruction that eventually motivates employees to rationally accept nominal wage cuts. Note that, given the product-price deflation that is characteristic of depression, In earlier-stage depression, TVGE labor pricing is consistent with significantly increasing real wages – a deeply problematic outcome, from the perspective of SVGE macro modeling, during an episode of exceptionally high unemployment.

coherently model. It is unsurprising that models constructed wholly on continuous-equilibrium market exchange would have trouble explaining market failure of the scale, scope, and durability produced in the 1930s.

The subset of NNS scholars who reject that high unemployment during the interwar period can be adequately understood as voluntary has typically relegated the most important economic episode of the 20th century to a special category for which the coherent SVGE worldview does not apply. The unhappy reliance on special categories helps explain the confinement of mainstream macro theory and theorists who maintain it to the stabilization-policymaking sidelines during the 2008-09 economic crisis.

Aggregate Demand Disturbances

The generalized-exchange platform accommodates usefully heterogeneous classes of nominal demand disturbances (DD), producing particular types of instability.[42] In the first, and most familiar, the stochastic real or nominal shock is promulgated by a high-frequency *stationary demand disturbance* (DD→SDD). In this class, adverse shifts in total spending are fully corrected, after a relatively short period, by automatic stabilizers augmented by standard central-bank "lean-against-the wind" monetary intervention. The stabilizers include endogenously reduced interest rates and increased public deficits, income-support programs triggered by involuntary job- and income-loss, and other countercyclical transfer payments. Meanwhile, confronted by adverse SDD, central banks largely task their discretionary interventions to speed up cyclical recovery, using open-market purchases of government short-term debt to increase system liquidity and further lower interest rates.

At the other extreme in the nominal promulgation of macro shocks, generating by far the greatest welfare loss, is unchecked *nonstationary demand disturbance* (DD→NDD). NDD features contracting aggregate spending sufficient to overwhelm both automatic stabilizers and orthodox central-bank interventions, relatively quickly inducing price deflation and chronic depression.

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[42] A more fulsome analysis of the nature and proper management of aggregate demand disturbances is provided in Chapter 10.

Here is the critical insight about acute instability. A necessary condition of any extreme contraction of aggregate demand, regardless of the originating macro shock, is the loss of investor-perceived credibility in the real-side (employment) objective of stabilization authorities. In such circumstances, collapsing demand and investor confidence will be shown to have combined in a destructive feedback system, the cumulative effect of which overwhelms the capacity of markets, automatic stabilizers, and orthodox management of short-term interest rates to stabilize the economy. Standard operating procedures will not suffice.[43] More powerful stabilization-authority intervention, quickly and in size, is needed to halt and reverse collapsing total spending.[44] (For elaboration, see Chapter 6.)

In between SDD and unchecked NDD is a third, more loosely defined class of total spending disturbance associated with stagnation that features stubbornly persisting $U > U^n$. *Constrained nonstationary demand disturbance* (DD→CNDD) induces substantially greater involuntary income loss than does SDD, albeit much less than NDD. During stagnation episodes, aggregate-demand growth (given meaningful wage rigidity) is inadequate to push down, at least more than slowly, excessive unemployment. Stabilization policymakers likely become frustrated with the ineffective standard repertoire of stabilization tools, encouraging experimentation with less orthodox interventions to stimulate total spending. An important question in stabilization analysis is what prevents CNDD from morphing into full-blown unchecked NDD.

In generalized-exchange modeling, welfare costs of adverse demand disturbances (DD) range from the lost jobs, production, and income resulting from significant, but relatively short (typically two years or so), cycles of recession and recovery (SDD) *to* chronic (perhaps extending to a decade or more) slow growth and persistently elevated unemployment (CNDD) *to* deep depressions along the lines of the 1930s economic devastation that result from unchecked contractions in total nominal spending (NDD). The differing outcomes depend the capacity of

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[43] In such circumstances, orthodox central-bank "lean-against-the wind" monetary intervention has been famously described as "pushing to a string". Moreover, if and when the nominal demand contraction induces price deflation, the interaction of falling prices and existing nominal debt further speeds collapsing total spending, creating a powerful flexible-price problem for SVGE endogenous cyclical stabilization. See, for example, Fisher (1933).

[44] A central role for confidence, of course, is not new. In his *General Theory*, Keynes asserts that inertial expectations of macro stability help maintain that stability until investor and lender confidence somehow shifts.

household and firms to adjust, the nature of the economic safety net, and the (interrelated) effectiveness and real-side credibility of stabilization authorities, all of which are easily accommodated in the TVGE model class.

Bernanke's Benchmark Depression Analysis

This section's depression analysis focuses on the TVGE capacity to microfound the coexistence of continuous economic equilibrium and chronically high and rising wage rents in the context of persistent, substantial excess labor supply. In particular, it microfounds the second of Ben Bernanke's (2000) two principal channels that motivated the 1930s global Depression. His first channel is the deflation-aggravated financial crisis that sharply curtailed aggregate nominal demand. Indeed, the Bernanke analysis concentrates on the collapse of money spending, deriving powerful conclusions that have stood the test of time and provided useful context for understanding the 2008-09 stabilization crisis. As a result, the second channel received relatively little attention and benefits from the workplace-equilibrium perspective.

Wage rents and unemployment persistence.   Bernanke's second causal channel focuses on increasing real wages, well above market-clearing levels, that were characteristic of the Great Depression.[45] He concludes that persistent, rising wage rents are the more difficult channel for economists to explain and, consequently, are the critical missing piece in the analytic puzzle of depressions: "… it seems that, of the two channels, slow nominal-wage adjustment (in the face of massive unemployment) is especially difficult to reconcile with the postulate of economic rationality. We cannot claim to understand the Depression until we can provide a rationale for this paradoxical behavior of wages."[46]

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[45] Bernanke rightly assigns much of the blame for the adverse behavior of his first channel to the broad acceptance of the gold standard. A necessary condition of gold-standard compatibility with the efficient operation of compliant economies is wage market flexibility. It is illustrative of fundamental economic change that the British interwar restoration of the gold standard, a spectacular policy failure, was contemporaneously justified by citing the resounding success of gold-standard restoration after the Napoleonic wars a century earlier. That the 19th-century restoration was successful while the 20th-century iteration was not is rooted in the interim Second Industrial Revolution and the ever-increasing importance of workplace labor pricing. Interwar macro policymakers, by and large, simply did not understand that a fundamentally relevant change in market constraints had occurred.

[46] Bernanke (2000), p.6. See also Friedman and Schwartz (1963), who use natural or policy-related stickiness to explain why wages and prices did not decline in proportion to the money-stock contraction in 1930-33.

BOX 5.6: HISTORY OF THE MACROECONOMICS OF ACUTE INSTABILITY

It is not surprising that the extreme instability of the 1930s Great Depression and its associated huge welfare cost stimulated substantial modeling of the meltdown. It is surprising how incomplete the research program remains today.

Most famously, Keynes (1936) and subsequent Keynesians (who founded macroeconomics as a separate field of economic theory) organized their efforts to explain the broad market failure around reversing the causality that long dominated economics. Keynesians centrally, and correctly, argued that changes in total nominal spending induced same-direction changes in employment and output, making rapidly contracting demand synonymous with acute instability. Having also identified a liquidity trap when the operative interest rate is near zero, the early Keynesians set aside relying on monetary policy in crisis, concluding that fiscal policy was the only effective means of discretionary total-spending intervention.

Milton Friedman (1963) shifted economists' thinking on the effectiveness of money with his massive empirical study of the Great Depression. The data showed close correlation between the contractions of employment/output and the money supply, which Friedman then asserted to be the causal force in the broad market failure. Twenty years later, Ben Bernanke (1983) looked inside Friedman's simple correlations. He concluded that the substantial breakdown banks' capacity to recycle saving into investment, not the money supply, was the central driving force in the 1930s contracting demand, acute instability, and consequent welfare losses. Bernanke's improved perspective served him, and the rest of us, well in 2008-09.

The macro narrative, however, was far from complete. Recent work has coherently modeled the channel through which contracting nominal demand induces involuntary job loss (a chronic omission in mainstream thinking that greatly worried Bernanke) and has usefully introduced technological change, uncertainty, and confidence into the saving-investment process:

- Technical change has greatly altered the financial system from the Great Depression to the Great Recession. Banks today are much less relatively important. Nonbank securitization, in its many manifestations, is playing an increasingly crucial intermediary role. By 2008-09, breakdowns in the commercial-paper market, the GSE mortgage market, money-market mutual funds, nonbank asset-backed lending, CDO conduits, hedge funds, etc. greatly restricted the economy's capacity to maintain total spending.

- Some theorists have usefully introduced the related phenomena of uncertainty and confidence into explanations of the Great Depression and Great Recession. (See Chapter 6.) The innovative modeling makes clear that both factors are needed to explain the characteristic substantial separation of mark-to-market asset prices and notional prices implied by economic fundamentals. Along the same lines, uncertainty and confidence are necessary to explain the distinctive speed and virulence of acute instability.

It is dangerous for policymakers not to understand depression, so it is helpful that generalizing exchange sheds substantial light on Bernanke's "aggregate supply puzzle". Especially useful is the derivation from optimizing behavior of how nonstationary shocks become embedded in the wage-price structure. Persistent, rising labor rents have long been prime suspects in the sort of economic breakdowns that produce macro stagnation. In 1937, for example, Bertil Ohlin wrote to Keynes that "… long-lasting unemployment may be due simply to the fact wages in the investment trades are 'too high' compared to the rest of the price system."[47]

In the TVGE model class, the direct means of breaking out of high wage-rent drag on economic activity is to provide large-establishment employees effective incentives for recalibrating their workplace reference standards ($\mathbb{K}_j$). At some point beyond the inherent long lags associated with continuous-equilibrium job destruction and wage givebacks identified in Chapter 3, prolonged stagnation implies that those incentives have broken down. The TVGE perspective identifies three (interrelated) reasons for additionally diminished workplace incentives to recalibrate $\mathbb{K}_j$ in the context of the 1930s episode of chronically high unemployment.

First is the *speed of relevant job loss*. In LEV workers' dynamic optimization modeled in Chapter 3, rational $\mathbb{K}_j$ recalibration requires both $\acute{\omega}^T_j > 0$ and a significant adjustment period. It follows that, if nonstationary employment loss occurs sufficiently quickly to allow job prospects in the particular establishment to stabilize (even at sharply reduced levels) within the time period required to recalibrate $\mathbb{K}_j$, the longer-lagged job-destruction effect is dissipated, causing rational wage rents to remain high. (See Chapter 3.) If the incidence of such dissipated firm-specific job destruction is sufficiently high, the economy can experience substantial excess capacity and labor-market inefficiency (albeit still consistent with the continuous-equilibrium timepath of employment) for a prolonged period.[48]

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[47] See Keynes (1973), p. 197.

[48] Milton Friedman has famously argued that the 1930s depression in the United States could have been avoided if the Federal Reserve had pumped out enough money sufficiently quickly. Coming from the problem in a different direction, the TVGE model class provides support for the necessity of quick and substantial policy responses to a legitimate threat of a NDD collapse in total spending. But the TVGE analysis also implies that monetary policy, to the extent that the central bank's balance sheet can be used to boost nominal demand, is not neutral in what is usually understood to be the medium term. (It is more precisely not neutral in the active-$\mathbb{K}$ periods that replace the medium- and longer-term in TVGE macrodynamics.) Note that the two-venue analysis does not imply that there is a policy-relevant medium-term tradeoff between inflation and unemployment. Many macro theorists have mistakenly

Crude evidence on job loss in the U.S. Great Depression is consistent with GWET analysis. The collapse in employment occurred from 1929 to 1932 and was sufficient to induce sharp reductions in money (but not real) wages. By 1933, employment had largely stabilized, while (producer) real wages were still rising. Along with the reduced threat of job loss, nominal wage cuts and product price deflation had ended by the early 1930s. More generally, Margo (1993) summarized the fundamental dilemma of the 1930s for neoclassical theory: "Why did unemployment remain persistently high throughout the decade? How can unemployment rates in excess of 10 to 20 percent be reconciled with the behavior of real wages, which were stable or increasing?" (p.43) From the perspective of TVGE thinking, the job stabilization at high unemployment that began in the early 1930s would have weakened employee incentives to recalibrate $\mathbb{K}_j$ and accept wage givebacks. Wage rents would have remained stubbornly high, as would LEV job rationing, labor-market inefficiency, and the natural rate of unemployment. (See Chapter 6.)

Second is the role of unions. By their nature, workers almost always trust their union more than their employer. That trust extends to forecasting future job loss. Consequently, formal labor organizations have the capacity to diminish employee incentives to revise existing workplace reference standards. In practice, that capacity is most used when the relationship between unions and management is antagonistic. Widespread, active union-management hostility (as opposed to a working relationship rooted in the mutual acceptance of the other's right to exist) can help keep the economy in a high wage-rent stagnation trap.[49]

Third is *government intervention*. In TVGE theory, government can significantly impair incentives to rationally recalibrate $\mathbb{K}_j$ and accept wage cuts, helping to sustain elevated wage rents. Support programs, including jobless benefits, income transfers, and public pensions, make permanent job loss a less effective inducement for voluntary $\mathbb{K}_j$ recalibration. They also make

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concluded that the apparent absence of a longer-term tradeoff implies that monetary policy cannot influence unemployment beyond the timeframe of stationary disturbances. (See, for example, Taylor (1998a).)

[49] For more on the formal modeling of unions and collective bargaining that is wholly integrated into the continuous equilibrium Workplace-Marketplace Synthesis, see Chapter 7.

employment in the (on-the-books) SEV venue less attractive to workers chronically displaced from LEV firms.

Furthermore, government intervention can expand the relative size of the venue capable of maintaining $\mathbb{K}_j$, weakening overall labor-market efficiency, by encouraging collective bargaining or linking the wages of unorganized workers to bargaining outcomes. Regulation additionally strengthens the durability of wage gaps by limiting imports, subsidizing exports, constraining entry to high-wage domestic industries, and extensively mandating the terms and conditions of employment. In the United States, for example, the Smoot-Hawley Act (1930) sharply increased tariff rates at the beginning of the Great Depression, helping to prolong it.[50]

Overall, given the right mix of circumstances, TVGE modeling indicates that wage rents and rate of unemployment can remain exceptionally high for a prolonged period. Chronic shocks can push unemployment well outside the corridor within which a market economy is self-adjusting. Axel Leijonhufvud (1981) has persuasively argued that a market system is like any control system that survives the test of time. It handles a normal range of disturbances well, but there is a limit to the size or type of disturbance that the market control system can deal with effectively. Stagnation economics must occur outside Liejonhufvud's self-correcting corridor.

Evidence. Recent work on longer-term stagnations and depressions indicates that workplace economics enable the construction of more adequate explanatory models. In a noteworthy example, Cole and Ohanian (2002) investigated the interwar depression in the United States and found considerable deterioration in labor-market efficiency in the 1930s. By the end of the period, the average wage was 25% above the level implied by surprisingly robust productivity growth. They attribute much of the chronic stagnation to the prolonged failure of wages to revert

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[50] TVGE modeling also provides channels for chronically depressed aggregate demand. Chronically high and rising wage rents depress profits and investment in the large-establishment venue, slowing investment while retarding the labor-absorption capacity of high-productivity firms. Reduced absorption puts downward pressure on wage rates paid in the market sector, while increased rationing unleashes adverse income multipliers throughout the economy. Persistently high wage rents, therefore, restrain the growth of consumption and investment spending, helping to reinforce economic stagnation. It should also be noted that a number of economists have emphasized a fourth reason for a low-inflation economic stagnation. *Money illusion* strengthens worker resistance to nominal wage cuts. See Akerlof *et al*. (1996). Nonmarket jam-ups of nominal pay adjustments for class-I workers in large or unionized establishments do appear to occur around zero. Such jam-ups are consistent with the unbundled wage condition derived in two-venue modeling, but the evidence may also reflect significant reinforcement from money illusion.

to their market-clearing levels and, in turn, attribute that failure to broad-based institutional change: the National Industrial Recovery Act (NIRA) of 1933 and the National Labor Relations Act (NLRA) of 1935.

From Cole and Ohanian (2002): "The NIRA suspended the antitrust acts in manufacturing and some other sectors provided that firms raised wages immediately and agreed to engage in collective bargaining. The policy permitted collusion and allowed labor to capture some of the monopoly rents. The NLRA increased labor bargaining power further by permitting unions to use previously unaccepted tactics such as 'sit-down' strikes, in which strikers forcibly took over factories and prevented production. Wages and prices rose substantially right after the NIRA was passed and rose further after the Supreme Court upheld the NLRA in 1937." (p. 30-31)

From the perspective of formal workplace economics, the regulatory changes increased the size and durability of wage rents (G). As has been shown, a more durable wage gap reflects a weakened capacity of firm-specific job destruction to induce revisions in established workplace reference standards. Overall, the labor-related explanation for longer-term stagnation implicit in workplace economics is consistent with the story presented by Cole and Ohanian and others.[51]

But the Workplace-Marketplace Synthesis does much more. The Cole-Ohanian analysis is conducted wholly within the SVGE framework and must ignore much of the evidence. Kniesner and Goldsmith (1987) summarized the familiar data, reporting that in September 1929, as the economic collapse was organizing itself, involuntary job loss began to rise and quits to fall. By December, job loss was triple its rate during the first half of the year, while the quit rate had fallen by half. Voluntary unemployment continued to play an inconsequential role throughout the Great Depression. From Kniesner and Goldsmith (1987, p.1256): "The layoff rate in manufacturing was very high during 1930-32, averaging about 4 per 100 workers per month, and the monthly layoff rate was persistently high throughout the 1030s, averaging just over 3 percent during 1933-37 and 2.7 percent during 1938-41. On the other hand, the monthly quit rate, which

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[51] See also Chari *et al.* (2002), who conclude: "Our business-cycle accounting suggests that research on the Great Depression should focus on building detailed models with underlying distortions that produce inefficiency and labor wedges. Building models of investment wedges is not likely to yield a high payoff." (p. 27) The authors define input "wedges" as the gap between the factor's marginal productivity and its market price.

averaged 1.3 percent during 1930-32, fell slightly to 1.2 percent during 1933-37 and declined more noticeably, to 0.96 percent, during 1938-40." Coherent SVGE modeling is inherently incapable of suppressing wage recontracting and, therefore, cannot explain the full range of evidence produced in the interwar Depression. By contrast, TVGE analysis easily explains the data produced by the greatest failure in stabilization policy in the modern era.

Evolution of financial panics. There were thirteen U.S. financial panics prior to the depression of the 1930s.[52] It is well understood why the economy, prior to the establishment of the Federal Reserve and Federal Deposit Insurance was especially vulnerable to periodic reductions in lender/investor confidence that threatened the ability of banks to survive. Less well understood is why those crises were short, relatively confined, and by modern standards not very costly. In the earlier episodes, neither the gold standard nor Andrew Mellon's belief that proper government policy was to facilitate broad liquidation were improper. However, by the 1930s, and certainly into the 21st century, both had become gasoline thrown onto a fire.

The critical difference is the Second Industrial Revolution, with its eventual dominance of high-volume production (with large-scale workplaces) and equity-based personnel policies.[53] By the 1930s, the MWR channel was transforming contracting nominal demand into involuntary lost jobs and income, both vigorously propagating the financial panic and generating persisting wage rents that were increasingly inconsistent with the deflating price structure. Nominal wages were no longer effectively downward flexible. Unlike earlier panics, real wages in the 1930s rose dramatically despite extraordinarily high and persistent unemployment. Macro policy needed to recognize the monetary nature of the debacle and pursue aggressive actions to revive total demand, a mandate that is separate from, and more important than, bank regulatory reform.

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[52] In 1910, Roger Babson identified thirteen financial panics in the United States: 1791-92, 1813-14, 1826, 1837, 1848, 1857, 1864, 1873, 1884, 1893, 1896, 1903, 1903, and 1907. The next two (1930-33 and 2008-09) were fundamentally different.

[53] It is illustrative that more than half of the U.S. labor force in 1870 was employed on farms; by 1930, the number had fallen to just over 20%. Today, it is under 2%.

BOX 5.7: RATIONAL WAGE DETERMINATION AND DEFLATION

Why don't nominal wages, especially given the influence of rational expectations, quickly incorporate product-price deflation?

Generalized-exchange labor pricing inherently adjusts slowly to deflation, principally for two reasons. First, the rational-expectations term $(E_t p^N(t+1) - E_{t-1} p^N(t))$ in the two-venue wage equation, specified in the previous chapter, plays no systematic role in wage determination in the circumstances of falling consumer prices:

- Recall that the rational-expectations term denotes credible changes in the monetary authority's inflation regime. Given the central role of deflation in widespread default on nominal debt, the destruction of wealth, and the collapse of aggregate demand, no rational central bank in a modern, specialized economy would adopt the contraction of the consumer price index as a policy objective.
- Moreover, the unchecked nonstationary collapse of total nominal demand, the macro circumstance most hospitable to deflation, itself destroys monetary-authority stabilization credibility. Deflations must be understood not as regime changes but as failures in the central bank's real-side responsibility to stabilize the economy.

Second, absent systematic influence from credible changes in the monetary authority's inflation regime, the influence of deflation on the timepath of nominal wages has been demonstrated to work through catch-up or job downsizing:

- Catch-up is, by definition, a lagged process that was rationally motivated in Chapter 4. Subject to that lag, it helps produce overall wage reductions when the absolute value of the rate of price deflation is greater than the continuous-equilibrium growth rate of real wages implied by established reference standards ($\mathbb{K}$).
- Reference standards can be rationally recalibrated, a process modeled in Chapter 3. Recalibration was shown to be critically motivated by the incidence of job downsizing, a phenomenon that itself requires relatively long lags.

The TVGE model's detailed predictions are consistent with the evidence on wage change in the 1930s depression. Nominal wage cuts occurred but significantly lagged product-price deflation. Reductions were sufficiently slow in the otherwise fast developing chain of events that (despite high and rising unemployment) real wages were pushed sharply higher, producing Bernanke's central mystery of the Great Depression.

Larger message. In the 20th century, with its widespread exploitation of specialization and increasing returns, the two greatest challenges to mainstream economic theory were the depression of the 1930s and the stagflation of the 1970s-1980s. It is discomfiting that broad consensus among economists about the nature, causes, and solutions to each costly disruption

has yet to be achieved. (Stagflation was analyzed in some detail in Chapter 4.) The Workplace-Marketplace Synthesis provides the foundation for the overdue, coherent consensus.

Stagnation

Adverse nonstationary demand disturbances are not exclusively associated with unchecked spending contractions and swift destruction of income and wealth characteristic of 1930s-class depressions. An additionally important problem set, *constrained nonstationary demand disturbances* (denoted by CNDD), is characterized by positive spending growth that is sufficiently inhibited to produce, in conjunction with MWR, a jobless rate (U) persistently greater than the natural rate (U^N). The meager SVGE stagnation literature typically poses a choice between classical and Keynesian unemployment; in the former, aggregate supply is distorted by chronic wage rent, while the latter assigns the starring role to inadequate demand. TVGE modeling, building on the derivation of the powerful MWR Channel from model primitives, coherently integrates the supply and demand forces into a policy-relevant model of macro stagnation, critical elements of which are sketched below.

Modeling stagnation. The microfoundations needed to explicate the CNDD problem class as a continuous-equilibrium phenomenon, occupying the space of welfare loss that exists between SDD and NDD, have already been provided. As already indicated, coherent stagnation modeling is constructed on keystone MWR that generates chronic time-varying wage rents and frustrates, along with interrelated sluggish nominal spending growth, profit expectations needed to support full employment ($U(t)=U^N(t)$). Medium-term wage-rent macrodynamics were modeled in Chapter 3, while LEV and SEV labor-price dynamics were the focus of the previous chapter:

$$G(t)=(W^n(t)/W^m(t)-1)=G^T(t)+G^V(t);$$

$$(5.5) \quad w^n(t)=r^n(t)+p^c_k(t)+E_t p^N(t+1)-E_{t-1}p^N(t);$$

$$w^m(t)=\gamma^m(t)+p^m(t); \text{ and}$$

$$(\dot{g}(t) \mid r^n(t)=\gamma^m(t)+p^m(t)-p^c_k(t)-E_t p^N(t+1)+E_{t-1}p^N(t))\approx 0.$$

The variable $\dot{g}$ denotes the rate of change in wage rent, measuring wage-structure stability. Recall from Chapter 3 the long lags required for job destruction to occur and then induce $\mathbb{K}_J$ recalibration and wage givebacks, implying LEV labor pricing that is insufficiently flexible to permit a broad range of medium-term reconciliation of chronically slow demand growth and $U(t)=U^N(t)$.[54] Dynamic conditions explicating stagnation in generalized-exchange modeling are:

$$(5.6) \qquad (\Delta\Pi_J^T(t) \mid \Delta \hat{D}_J^T(t) > \Delta(G_J^T(t)W^m(t)H_J^T(t))) > 0 \text{ and}$$
$$(\Delta\Pi_J^T(t) \mid \Delta \hat{D}_J^T(t) < \Delta(G_J^T(t)W^m(t)H_J^T(t))) < 0,$$

where Π_J^T denotes nonstationary LEV nominal profit and $\hat{D}_J^T$ is nonstationary Jth venue demand net of capital-stock rental costs.[55] In LEV firms, profits are increasing in spending and decreasing in wage rent. In circumstances of $U(t)>U^N(t)$, robust profit growth, expected to persist, supports robust investment in plant, equipment, software, and R&D as well as the sufficient creation of LEV (good) jobs to push down unemployment. By contrast, weak nonstationary profit expectations make investors less willing to support the existing level of productive capacity, hindering employment growth and eventually inducing LEV job downsizing and, after more delay, wage givebacks. (For elaboration, see Chapters 3 and 6.)

The macro literature features two end-point approaches in the spectrum of policymaking in the circumstances of stagnation. The first is activist stabilization, targeting medium-term alignment of $U(t)$ and $U^N(t)$, that attempts to stimulate total spending sufficiently to boost profit expectations, investment, and employment. In this Keynesian response, increased nominal spending helps reconcile unchanged (or slowly changing) $\mathbb{K}_J$ and full employment.[56] The second is the passive classical solution, in which the monetary authority eschews overt action, relying

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[54] Chapter 3 demonstrates that optimal workplace exchange, influenced by the hold-up problem, increasing returns, labor-cost cartelization, etc., imparts substantial persistence to established wage reference standards embodied in r^n.

[55] Recall from Chapter 3 that $\hat{D}_J(t)=P_J(t)X_J(t)-\tilde{r}^m(t)K_J^\tau(t)$.

[56] See, for example, Malinvaud (1980). Rothstein (2012) analyzed the persistently high unemployment in the aftermath of the 2007-09 recession and concluded that the poor performance resulted primarily from inadequate aggregate demand, not structural factors.

instead on spontaneous market adjustments to inadequate profits that correct stagnation by eventually reducing wage rents sufficiently to reconcile total demand and $U(t)=U^N(t)$.[57]

In TVGE modeling, neither the active nor passive policymaker approach to dealing with persistently high joblessness associated with stagnation is without challenge. The Keynesian policy response cannot lower the natural rate of unemployment nor can it assure sufficient acceleration in total spending; it also can suppress labor-price adjustments that are necessary for overall economic efficiency and competitiveness, especially internationally.[58] Stabilization authorities' capacity to induce sufficiently higher aggregate-demand growth may be limited by powerful structural problems, including high debt burdens, sharp deteriorations in labor's terms of trade, nonmarket forces that hinder adjustment in global currency markets, other nations' free-riding on stimulation efforts, and political paralysis.

On the other hand, the critical problem with the classical policy response is that wage givebacks require accumulating job destruction, a long-lagged adjustment process that imposes substantial damage to productive capacity, wealth, living standards, and economic prospects. The Tobinesque costs associated with relying on begrudging rational $\mathbb{K}_j$ recalibration to produce full

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[57] See Chapter 6 for elaboration on the range of influences that can inhibit profit expectations. Most generally, investor anticipations depend on both the size and nature of pure profit. Large-scale cost-cutting may boost profits by cutting jobs, while top-line revenues from higher demand both increase residual rents and encourage capacity expansion and more hiring. Meanwhile, the level of $U^N(t)$ is determined by many factors (typically dominated by skill mismatching), with a relatively limited role played by wage rent. Nonmonetary policymakers can help speed the classical process by working to eliminate skill bottlenecks and otherwise lessening impediments to market adjustments. A passive central bank may at some point also benefit from a fortuitous positive demand shift.

[58] One important scenario is recognizable from difficult episodes of stagnation management that occurred during and after the stagflation decade. At issue are widespread job destructions that were eventually induced by rising LEV labor rents that resulted from the period's signature extreme commodity-price inflation, the macro shock that ultimately blew inter-industry wage structures apart. Increasingly rationed good jobs generate spillover rationing in other markets that combine to inhibit total spending. Adverse multipliers reduce the effectiveness of policies designed to stimulate demand. As noted, the design of those policies is made even more difficult by the requirement rooted in economic efficiency not to suppress the necessary wage adjustments. The integrated analysis is a big deal. Only coherent generalized-exchange macro modeling is capable of incorporating the Thatcher revolution in Britain and the spontaneous downsizing of basic industries in the U.S., uniquely enhancing its policy relevance. I should transfer this footnote to the main text. It also should be noted here that in a stagflation context effective demand stimulation may require unacceptable levels of inflation, a circumstance that I know restricted the latitude of stabilization authorities in the stagflation decade. (For elaboration, see Chapter 4.)

employment are sufficiently large to mandate high-priority central-bank exploration of the feasibility of more activist policies whenever U(t) persists above U^N(t).[59]

The late Edmond Malinvaud (1980), the highly respected French macro theorist and policy advisor, constructed a medium-term profit-centric model that provides antecedent roots for the generalized-exchange analysis of stagnation.[60] He powerfully extended the stationary fixed-wage general-equilibrium (FWGE) model class, associated with Patinkin (1956), Clower (1965), and Barro/Grossman (1971). FWGE thinking fell out of favor when it became clear that adherents were unable square their necessary wage rigidity with optimizing exchange. The field, however, was not completely abandoned. Notably continuing in the spirit of the early FWGE analysis is the careful work by Jacques Drèze's (2001a, 2001b) on supply-constrained equilibria. TVGE modeling, inspired by Malinvaud, Drèze, Bénassy, and other active fixed-wage macro theorists, fully microfounds the FWGE approach and will hopefully encourage interest among a new generation of students. It is difficult to imagine policy-relevant formal macro theory that does not have roots in FWGE thinking, and the analysis returns to that literature in the next chapter.

Putting it together. Low-frequency variation in unemployment presents a difficult problem set to stabilization policymakers. Unlike high-frequency joblessness for which the continuous equilibrium MWR channel establishes the central causal role of nominal demand, the TVGE low-frequency narrative establishes no single explanation to guide macro interventions. Indeed, an important task of TVGE macroeconomics is to discourage theorists' urge, in considering stagnation, to focus on a single cause. Giving in to the desire to simplify the stagnation problem has proven to be a debilitating mistake. Central banks, aspiring to effectively respond to high nonstationary unemployment, must do the hard circumstance-specific analytical work of calibrating the relative roles of persistently inadequate total spending and persistently high real

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[59] Effective stabilization policymaking requires state-of-the-art capacities to estimate U^N(t). (See Chapter 6.)

[60] Despite being limited by a crude specification of wage rigidities, Malinvaud's model of medium-term market failure pieces together a series of short-term equilibria that transforms, in the cumulative medium term, classical unemployment (rooted in wage rents) into Keynesian unemployment (rooted in inadequate nominal demand). In reviewing Malinvaud, Solow (1981, p.572) placed his analysis firmly in the practical core of macro theory: "To get anywhere with this issue, one must face up to the endogenous interaction of real and nominal variables."

wages.[61] Both causal forces are rooted in MWR, implying that such policy-relevant analysis is coherently done only within generalized-exchange modeling.

Throughout the exposition of exchange generalization, the relationship between nominal demand and involuntary job loss has been emphasized. That focus, however, should not obscure that TVGE theory also richly models the rational macrodynamics of market-inefficient wage rents. In particular, Chapter 3 critically identified long lags before profits weakened by nonmarket labor pricing induce job destruction, which then requires even more time to soften downward labor-price rigidity. In addition to chronically inhibited demand growth, important causal roles in unemployment persistence have been identified for high reservation wages (rooted in stable preferences, jobless benefits, and market-information discovery costs especially associated with job downsizing), various labor-market rigidities (e.g., government restrictions on firms' capacity to reduce their workforces), the structure and scope of formal bargaining (see Chapter 7), and the evolving wage structure and its interplay with capacity adjustments and labor-rent givebacks. In the TVGE analysis, other causal forces that have received attention in the literature have properly fallen by the wayside, including productivity regress, variable job-matching efficiency, hysteresis rooted in skill deterioration, and taxes on labor income thought (even in small doses) to powerfully discourage labor-force participation.

Cross-national differences in unemployment and the composition of job growth, especially over the past three decades, draw attention to the need for policymaking to be supported by TVGE modeling. The special role of LEV employment, sharply rationed for a substantial share of the labor force since the Second Industrial Revolution, must be understood if macro policies are to effectively promote rising living standards in economies throughout all their stages of development.

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[61] Nonmonetary policymakers must also diligently work on existing structural problems, including skill mismatching.

BOX 5.8: NEW BIG IDEA IN MACROECONOMICS

In his interesting <u>Big Ideas in Macroeconomics</u> (2013, p 2), Kartik Athreya pays proper homage to the biggest idea in the literature: "... the bedrock 'Walrasian general-equilibrium' framework, the modern version of which is known as the Arrow-Debreu-McKenzie (ADM) model…. A sense of the profound importance of this model can be gleaned from the fact that modern macroeconomics, which seeks to understand and interpret important real-world economic 'aggregate' time series such as GDP, interest rates, inflation, inflation, and unemployment, and is the source of many of the most influential policy interventions into the economy, is overwhelmingly based on applications of models rooted in the basic ADM model. In macroeconomic applications, many additional frictions and 'bells and whistles' are added to allow models to make contact with empirical phenomena, but the point of departure is essentially always ADM; in most macroeconomic models in use today, one can recover the pure ADM model as a special case."

It is a big deal that another idea, the generalization of exchange, has forced a fundamental reconstruction of the core ADM (aka SVGE) model. Both the SVGE and TVGE frameworks are coherent. While the latter loses no information from the former, the reverse is not true. Most consequentially, the workplace venue uniquely introduces the MWR Channel and involuntary job loss, both layoffs and downsizing, into continuous-equilibrium behavior, providing a rational link from adverse nominal disturbances to substantial real-side effects. As a result, the TVGE approach is much more capable of modeling the GDP, interest rates, inflation, and unemployment that actually occurred over the past hundred years than the more restricted SVGE theory. The beautiful, coherent ADM model has for a long time been deeply challenged by stabilization relevancy and must give way to the new big idea of two-venue general equilibrium.

The reconstruction of the SVGE core to accommodate rational exchange in the workplace will eventually be accepted by mainstream macroeconomists. Advantages of the merger, three of which are noted here, extend well beyond stabilization-relevancy and are simply too powerful to resist. Unlike SVGE modeling, the TVGE framework derives its critical general-equilibrium labor supply from preferences and technological constraints that are truly axiomatic, rather than simply convenient. The generalization of exchange also makes macro modeling more tractable, an outcome that especially results from permitting temporary and persisting excess demands in a broad range of markets to be consistent with continuous decision-rule equilibrium, easing the crucial decomposability problem. The new big idea additionally recognizes obvious facts about specialized economies, notably admitting big bureaucratic firms into coherent analysis and freeing theorists from their implicit, embarrassing focus on yeoman farmers. Students will be pleased.

VI. ANOTHER USEFUL MODEL: FINANCIAL INTERMEDIARIES

The financial sector is responsible for recycling savings and, therefore, exerts an especially powerful influence on total nominal spending in any specialized economy. At this point in the development of TVGE theory, it is helpful to introduce, albeit crudely, financial institutions. The brief analysis is a bare-bones overview, best understood as a placeholder for future elaboration.

Stripped to their core activities, financial intermediaries gather savings from households and firms and underwrite loans that (in part) fund business and personal spending, extending capital investment and consumption beyond the limits of self-finance. Firms and households can consume and invest more or less than their incomes, latitude that permits the total demand for goods in a closed economy to vary from total income. To invest without saving, to save without investing, or to dissave without disinvesting requires financial institutions to arrange and price the placement of loans and securities. As a result, among the greatest threats to the stability of total spending is a breakdown in the funding of financial institutions. More generally, failure to wholly recycle saving into spending implies contracting nominal demand and, in combination with the MWR channel, substantial and cumulative reductions in total employment and production. That critical class of market failure is our second example of *meta-externality*, in which rational behavior by banks and their funders aggravate cyclical instability, translating into involuntary job and income loss.[62]

The macro externality here results from a mismatch between efficient solutions for banks' asset-management problem and policymakers' macro stabilization problem in circumstances of adverse nominal demand disturbances. In business-cycle contractions, with associated current and expected credit and asset-value losses, rational bank strategy must include managing both its capital and liquidity to be sufficient to survive asset write-downs (calibrated to less-than-baseline

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[62] It is well understood that the Walrasian assumption of continuous full employment requires the efficient transformation of nominal saving into nominal spending. That transformation became tricky in the aftermath of the Second Industrial Revolution with its new corporate forms and their inherent suppression of wage contracting. The neoclassical narrative then required general investor/lender optimism with respect to future (planning-period) full-employment stability – an especially arbitrary restriction when aggregate-demand fluctuations consequentially interact with the MWR Channel. Operationally, the assumption of macro stability can be replaced with the credibility assigned by investors/lenders to stabilization authorities' real-side objective.

probability stress tests) and skittish creditors. The economic circumstances necessarily imply tightening underwriting standards, which reduces losses, shrinks total asset size, and increases the capital available for loss absorption. Rational bank management must restrict lending, to some degree, in periods of contracting demand.[63]

Greenwald and Stiglitz (1993) have constructed an illustrative banking model that can be readily introduced into the TVGE model class, identifying and motivating credit rationing in specialized economies broadly subject to information costs and asymmetries. In particular, they argue that banks, which are highly leveraged with substantial nominal obligations, are both risk-adverse and have imperfect information on the macroeconomic risk partly governing loan repayment, producing variable credit rationing as banks' assessment of cyclical risks evolves. From Greenwald and Stiglitz (pp.31-32): "When economic conditions worsen, banks perceptions of the relative risk of loans increases; and since bad economic conditions are often accompanied by high default rates, banks' net worth decreases, along with their willingness to bear risks. On both accounts, banks respond to bad conditions by shifting their portfolio toward the safer activity." Rational lending institutions procyclically influence total spending, complicating the task of the stabilization authorities. The simple credit model can be easily generalized to the ubiquitous (and inherently less regulated) shadow banking sector, especially securitized lending.

In stressful macro circumstances, particular attention must be paid to short-term funders of a broad range of financial intermediaries, featuring temporarily cash-surplus institutions that include nonfinancial corporations, insurance companies, pension funds, mutual funds, hedge funds, and investment banks. As their imperfect perceptions of the macro outlook and creditworthiness deteriorates, their appetite for lowest-risk assets (including cash) increases.[64] Rational behavior is then broadly restricting funds available to financial intermediaries, increasing systemic liquidity risks and aggravating downward pressure on total nominal demand.

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[63] For elaboration, see Hanson, Kashyap, and Stein (2011) and Dewatripont, Rochet, and Tirole (2010). The simple banking model, having roots in Kareken and Wallace (1978) and Diamond and Dybvig (1983) and ultimately traceable back to Walter Bagehot, makes no claims to originality.

[64] Equivalently expressing the point, the appetite for cash and U.S. Treasury debt increases as confidence in the stabilization authorities' capacity and commitment to halt and reverse a nominal demand contraction deteriorates.

Meanwhile, macro policymakers tasked with stabilizing employment and production are seeking to halt, and reverse, the adverse spending disturbance. In SDD circumstances, intermediaries' rational procyclical asset management is overcome by automatic stabilizers and central-bank garden-variety open-market operations to reduce short-term interest rates and increase liquidity. The inconsistency between macro stabilization goals and rational bank micro behavior is not policy-relevant. However, in NDD circumstances, automatic macro stabilizers plus central-bank standard stimulative policies are inadequate to the task of reversing the demand contraction, increasing the criticality of the conflict between policymaker macro goals and intermediary micro goals.[65] In extreme macro crises (when appropriate stress tests include a nontrivial probability of depression conditions that would wipe out shareholder equity), banks rationally and substantially reduce lending. Given that the resulting meta-externality reflects market failure, not bank irrationality, the buck stops at stabilization policymakers. Most notably, the Federal Reserve must be responsible for the careful use its balance sheet to construct a comprehensive and credible toolkit of timely interventions capable of preventing the self-feeding shrinking of aggregate demand that push economies into prolonged stagnation (e.g., Japan's lost decade) or depression (e.g., the 1930s).

Adequate macro theory must specify and accommodate the rational MWR Channel, the inherent procyclical instability produced by rational financial intermediaries, and the crucial role of the real-side credibility of stabilization authorities. This compact version of generalized-exchange modeling has usefully focused on the most analytically difficult of the three interrelated issues (i.e., rational wage rigidity). The analysis returns to the emotionally difficult problem of central-bank credibility in the next and last chapters.

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[65] The contraction process has been closely modeled by Shleifer and Vishny (2010b). They focus on securitized lending where banks retain only a portion of loans made as "skin in the game", selling off the remainder to investors. (Their argument, however, applies to the entire portfolio of bank "at-risk" assets.) Interesting problems occur if market sentiment on one or more important classes of bank assets sours, adversely affecting (regulatory and equity) capital and forcing liquidation at the same time competitors are doing the same. Shleifer and Vishny have named such liquidation "asset fire sales" and assert they reflect "price dislocation", i.e., the overshooting of asset values relative to economic fundamentals. Price dislocation itself partly reflects information asymmetries, and banks respond to their superior information by rationally choosing to maintain the now price-distressed asset positions. Banks instead reduce funding new projects, which are expected to yield lower returns than existing assets. From Sheifer and Vishny (2010a, p.46): "Because efficient projects are not financed in such a crisis, there is room for *ex post* government intervention, including credit easing, to improve efficiency."

BOX 5.9: MISTAKE OF HISTORIC PROPORTIONS

The U.S. Federal Reserve, along with other G-7 central banks, has recently concentrated on better preparing the economy for future metamorphoses of SDD into NDD. Their interest in preventing the class of disturbance associated with the extreme global instability that began in 2008 is not surprising. In that effort, however, they have focused on the regulation of the banking system. Their belief that the policy lesson of the huge welfare loss from the economic crisis is centered on sharply higher capital and product restrictions imposed on the banking system is, at best, misplaced. History and logic demonstrate the futility of relying on regulation to prevent bank runs and asset fire-sales that result from lost investor and lender confidence in future macroeconomic stability. Meanwhile, the ubiquity and dynamic nature of the shadow banking system is testament to the mistaken belief that relevant financial risk can be confined to the effectively regulated banking system. Central banks must instead admit to, and work to correct, their own problems. In particular, they must understand how inadequately they have invested in promoting the credibility of their capacity to stabilize the real side of the economy. For example, at this writing, the Fed has inexplicably not established a formal employment target. Indeed, most other central banks assert that low inflation is their single objective. The critical defense against a repeat, perhaps even more powerful, of the 2008 SDD→NDD instability, is to assemble a formidable toolkit of actions, creatively using the central-bank balance sheets, that sufficiently intervene in total spending and asset pricing to halt and reverse a collapse in nominal demand. The fool's errand, replacing the hard work of strengthening central-bank real-side credibility, is to rely on aggressive banking regulation, with its inherent limitations, to prevent future collapses of macro-stability confidence.

If lenders and investors in 2008 were confident that the Federal Reserve had the means and the will to halt and reverse the contraction in total spending, making a convincing case against depression, the overall welfare damage from the financial crisis largely rooted in the U.S. housing bubble would have been relatively minor. Certainly the resulting job loss would have been nowhere near 6 million and the stock market would not have gyrated around a 50% loss in value. On a macro scale, the event would have been ranked among the class of mild (SDD) recessions.

There is an important real-time message here. By not using the aftermath of its successful 2008-09 intervention in aggregate demand to strengthen its toolkit and aggressively seek credibility and authority for future large-scale stabilization efforts, the Fed is making a mistake of historic proportions.

VII. CONCLUSION

Aggregation is a defining feature of any macro model, yet modern theorists pay little overt attention to the nature and consequences of the methodologies they employ. SVGE modelers ubiquitously posit a single representative household that both supplies labor to and owns the single representative firm. That choice wipes out a great deal of information, including fundamental technological and organizational heterogeneities, that is critical to the aggregate behavior of specialized economies. With their first simplifying assumption, mainstream theorists eradicate their capacity to coherently suppress wage recontracting and accommodate involuntary job loss, condemning their efforts to stabilization irrelevancy.

Exact aggregation.   Solow and Hahn's (1995, p.105) lament about restrictive "exact aggregation" used in macro modeling is another frequent criticism of the SVGE approach: "The injunction to 'pay attention to the microeconomic foundations of macroeconomics' is too sensible for anyone to wish to reject it. In practice, however, the convention has ascribed legitimacy only to models that are exact aggregations of agents who optimize subject to constraint. Such models certainly pay attention to their micro foundations. Indeed they *are* their micro foundations. More often than not, however, proponents of such models have been willing to entertain as legitimate constraints only those expressing technology and budgetary consistency; and only conventional individualistic utility functions are thought to be respectable."

The two veteran theorists' judgment is, as usual, sensible. But, in this case, their reservations are unnecessary. It turns out, perhaps surprisingly, that playing by NNS rules of exact aggregation of households and firms in continuous equilibrium can be made consistent with macro modeling that produces a range of useful stabilization theorems. The critical restriction on TVGE aggregation, rooted in the Second Industrial Revolution, is the maintained separation of marketplace and workplace venues of optimizing exchange.[66]

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[66] Solow and Hahn are particularly justified in their general misgivings about the exclusivity of the ascendancy of New Classical macroeconomics in the most prestigious graduate programs and professional journals. Proper microfoundations are more than an esoteric academic debate. The issue has important implications for real-world policymaking. Gali and Gertler (2007, pp.25-26), for example, have persuasively argued that the new classical attack on the microfoundations of large econometric models combined with the models' failure to forecast the 1970s

BOX 5.10: THE NEW CLASSICAL REVOLUTION MATTERS

The New Classical macroeconomic insurgency of the 1970s that replaced the Early Keynesians as the academy's mainstream has two fundamental arguments. First, expectations should be rational. Second, macro models should be constructed consistent with the formal economic method of optimizing exchange organized around continuous general equilibrium. The New Classical Revolution has been both essential to the progress of macro thinking to be stabilization-relevant and deeply misunderstood.

Rational expectations dominated the prolonged debate that accompanied the New Classical revolution. In retrospect, the emphasis is surprising given the uncontroversial content of the core idea. Who disagrees that agents populating macro models should cost-effectively acquire and use relevant information in support of their economic decision-making? The Rational Expectations Hypothesis in which agents know all the information produced in the model despite its cost or inherent asymmetry is, of course, a different story. Surely nobody really believes that perfect foresight is usefully imposed on models with aspirations to be policy-relevant.

While the expectations argument, in its realistic version, was received as revolutionary and garnered the attention, it is the second argument that matters. Indeed, once macro modeling is made consistent with the formal economic method, rationally constructed expectations are no more than part of the standard drill. Indeed, in the context of careful adherence to the formal method, rational expectations are not particularly consequential in the proper design of stabilization policy.

The New Classical insurgents plausibly insisted that macro theorists write down the equations that capture the optimizing impulse and constraints of SVGE theory and then take them seriously. They particularly rejected the Keynesian and monetarist practice of imposing assumptions that arbitrarily determine the direction of the model's cause-and-effect. Rather than using assumptions to generate important results, proper model-building should derive cause-and-effect from rational behavior grounded in axiomatic model primitives. New Classical theorists are correct in asserting the primacy of the formal economic method. Their failure to construct stabilization-relevant macroeconomics results instead from not caring enough about how specialized economies actually work. They failed to recognize the fundamental need for the generalization of exchange in order to liberate their analysis from the arbitrary, damaging confinement of exchange to the marketplace.

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stagflation to drive quantitative macro modeling out of favor at central banks, hollowing out the capacity of economists to support policymaking: "In the 1980s and 1990s, many central banks continued to use reduced-form statistical models to produce forecasts of the economy that presumed no structural change, but they did so knowing that these models could not be used with any degree of confidence to predict the outcome of policy changesThus, monetary policymakers turned to a combination of instinct, judgment, and raw hunches to assess the implications of different policy paths for the economy." For elaboration, see Chapter 10.

Equilibrium macroeconomics. Generalizing exchange delivers theorists from the unhappy SVGE trade of stabilization relevancy for model coherence, i.e., continuous general equilibrium microfoundations. Progress has been enabled by more careful consideration of aggregation, building a bridge from micro behavior to economic aggregates that preserves heterogeneities most critical to the actual nature of optimizing exchange in modern, specialized economies. Critical TVGE assumptions are consistent with available evidence.

TVGE modeling shares the bold conjecture of real-business-cycle theorists that well-specified general equilibrium theory and formal macroeconomics must be equivalent. Despite the shared conjecture, however, equilibrium produced in the SVGE and TVGE models fundamentally differs. In the latter, optimizing workplace exchange provides the core around which general equilibrium is organized. LEV labor pricing dominates SEV wages, constraining decision-rule optimization in the marketplace and accommodating continuous-equilibrium (stationary and nonstationary) market failures to clear.[67] Freed of the decomposability problem, homogenization effectively supports tractable aggregation up to the workplace and marketplace venues of rational exchange, producing a timepath of total employment (through expansion, contraction, recovery, downsizing, stagnation, and more) that is consistent with dynamic decision-rule equilibrium.

Edward Prescott has put forward a constructive model-use guideline: "There never is a right or wrong model – the issue is whether a model is good for the purpose it is being used."[68] His sensible rule implies that the coherent friction-augmented SVGE framework be reserved for the analysis of circumstances in which wages can be recontracted and job separations are wholly voluntary or for cause.[69] TVGE modeling is appropriate in the remaining circumstances,

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[67] Odagiri (1981) interestingly constructed a formal macro model decomposed into corporate and market venues, demonstrating that the former dominates the growth process.

[68] Quoted in Snowdon and Vane (2005), p. 353.

[69] Even in that restricted use, it should be noted that SVGE models suffer from poor tractability that limit their application. From Chiarella, Flaschel, and Franke (2005, p.3): "Most importantly, the nature of the solution procedures for stochastic intertemporal [market-centric] optimization models makes it very difficult, if not impossible, to understand clearly the dynamic linkages and feedbacks between the various sectors and agents of the economy." Also, from David Romer (2001, p.153): "… moving from the *ad hoc* [consumption] assumption in IS-LM-AS to a relatively simple formulation based on intertemporal [market] optimization has little or no benefit in terms of realism, but a large cost in terms of ease. The tradeoff is similar for grounding the analysis of investment

microfounding dynamic general-equilibrium modeling that features meaningful labor-price rigidity, involuntary job/income loss, and consequent market failure in response to aggregate nominal-demand disturbances. TVGE thinking preserves Pareto Optimality while having no need for familiar SVGE Ptolemaic conveniences: implausibly high intertemporal labor-supply elasticities, large exogenous technological regress, and arbitrary preference shifts. The generalization of exchange notably enables rejection of the SVGE inference that the 1930s depression was a one-off epiphenomenon, an erroneous conclusion that has helped motivate misleading policy advice including the superiority of a single stabilization objective (i.e., low inflation) for central banks. (See Chapter 10.) By contrast, coherent TVGE thinking accommodates NDD in its various forms, establishing at least equal importance for a credible employment objective.

Complex and changing topography of wage rents. The two-venue macro model is, of course, a heuristic device. It masks reality's greater variation in economic characteristics, including establishment size, firm-specific capital, technological change, the nature of workers and jobs, product-demand elasticities, union power, and government intervention. Given the real world's more subtle gradations, rational labor pricing implies an ever-changing topography of wage rents associated with many heterogeneous venues. (Delineation along industry lines is especially appealing.) Adverse chronic shocks occur, and venue-specific market, technological, institutional, and legal circumstances produce differing capacities to maintain labor and residual rents. Patterns of simultaneous, long-lagged adjustments in a fluid subset of firms and industries as profits and wage rents become unsustainable are characteristic of specialized, market economies.

The shifting topography of profits and labor rents also influences the translation of aggregate spending into employment, production, and inflation, helping to determine the effectiveness of discretionary demand management. Playing a particularly powerful role in the dynamic-rent topography is the ebb and flow of government regulation of the employment relation,

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demand, money demand, price rigidity, and so on more strongly in microeconomic foundations: even the easiest models are dramatically harder than their IS-LM-AS counterparts, and not obviously more realistic."

international trade, product-pricing power, credit markets, and capital mobility into and out of industries. TVGE tools support economists' evaluations of those problems and remedial policies.

Generalized-exchange theory provides powerful macrodynamics partly because it does not rely on arbitrary time-separations. Empowered by workplace and marketplace forces governing job creation and loss, important economic processes (from business cycles to growth) occur simultaneously, interacting with and being shaped by the time-contingent shifts in the economic-rent topography. Specialized economies never reach a general state of market clearing, no matter how much time passes. But, at any given time, a subset of establishments are experiencing sufficiently substantial and ongoing job destruction to motivate their labor pricing to be more responsive to product-market forces, eventually improving that pocket of allocative efficiency.

Better macroeconomics. All the richness of specialized economies cannot be tractably captured in macro theory. Models must simplify. But some simplifications are less damaging than others. The TVGE model class preserves sufficient heterogeneity, while remaining tractable, to accommodate the fundamental transformation of the global economy induced by the Second Industrial Revolution and is, as a result, much more stabilization-relevant than mainstream SVGE thinking.

The 2008-09 macroeconomic crisis dramatically emphasized the need for improved capacity to model the class of broad market failure associated with adverse disturbances in total spending. In particular, the crisis exposed the pressing need for coherent analysis of nonstationary aggregate demand contractions. The generalized-exchange model class provides what the SVGE framework cannot: a formal continuous-equilibrium theory of depression and stagnation that assigns a central causal role to total nominal spending. The improved analysis implies that close attention must be paid to the adequacy and credibility of central-bank toolkits used in the management of aggregate demand. In particular, monetary authorities must do better in understanding and managing investor and lender confidence in the prospects for macro stability.[70]

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[70] For elaboration, see Chapters 6 and 10.

BOX 5.11: WHAT'S 'ABSOLUTELY CENTRAL' IN STABILIZATION THEORY?

Early in his fine New Keynesian text <u>Macroeconomic Theory</u> (2011, p.25), Jean-Pascal Bénassy identifies a "particularly important issue, that of government policy effectiveness. It is shown notably that hypotheses on information and expectations formulation are absolutely central in assessing whether government can actually control the evolution of employment and output.".

In developing its improved macro model, this book demonstrates that Benassy's confident conclusion about expectations and information, a generally accepted assessment that has directed cutting-edge research for more than three decades, is little more than an artifact of arbitrary SVGE restrictions on the scope of rational, price-mediated exchange. The artifact has diverting much of the rigorous thinking about stabilization-relevant macroeconomics into largely unproductive areas. That misdirection is central to explaining the paucity of useful stabilization theorems that have resulted from a generation of mainstream-theorist analysis.

In the TVGE model class, meaningful wage rigidity and its MWR Channel are what is 'absolutely central', remaining robust even in the perfect foresight circumstances of the Rational-Expectations Hypothesis. The generalization of exchange posits expectations that efficiently use available information, including all that is known about the behavior and plans of stabilization authorities. After eliminating the arbitrary marketplace-only constraint on rational exchange, the most critical restriction on information is its asymmetric nature in large, specialized workplaces.

No reasonable debate rooted in the formulation of expectations or the nature of information will attend the derivation, from model primitives, of the generalized-exchange capacity to microfound government stabilization effectiveness. Indeed, the inherent market failure resulting from the MWR Channel interacting with nominal demand disturbances, producing welfare loss manifest in large-scale involuntary job and income loss, is shown to be best understood as a meta-class externality. Following Pigou's careful analysis, such externalities mandate government intervention. Generalized exchange may seem like an unfamiliar exercise that requires theorist retooling to appreciate what occurs in the specialized workplace, but its unique capacity to properly answer big questions makes it worth the effort. The MWR Channel is 'absolutely central' to stabilization-relevant coherent macroeconomics. SVGE modeling, absent free parameters and despite its interesting work on information and expectations formulation, is inherently not up to the task.